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A
SYSTEM
OF
SURGERY:

BY

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OF EDINBURGH.

ILLUSTRATED WITH COPPERPLATES.

VOLUME VII.

THE SEVENTH EDITION,

CORRECTED AND ENLARGED.

EDINBURGH:
PRINTED FOR BELL & BRADFUTE, AND C. DICKSON;
AND G. G. & J. ROBINSON, MURRAY & HIGHLEY,
J. SCATCHERD, C. LAW, T. KAY, J. WALKER,
AND G. CAWTHORN, LONDON:
BY AD. NEILL AND CO.

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A

SYSTEM

OF

SURGERY.

CHAPTER XXXIX.

Of FRACTURES.

SECTION XII.

Of Fractures of the Femur or Thigh-Bone.

WE meet with fractures in every part of the femur; but more frequently in the middle than in any other part of it: Next to this, that part of it which we term the Neck of the Femur, is moſt apt to be fractured.

Fractures of all the under part of this bone are for the moſt part eaſily diſtinguiſhed, by the uſual grating noiſe produced by the ends of it being forcibly rubbed together; by the limb being much ſhortened if the fracture is oblique, or the ends of the bone diſplaced where the fracture is tranſverſe; by much pain and tenſion over the injured part; and by the limb being rendered unable to ſuſtain the weight of the body.

It is often difficult, however, to diſtinguiſh fractures of the neck of the femur from diſlocations of this bone; but a due attention to the following circumſtances will enable us for the moſt part to avoid miſtakes in regard to this, which are always attended with ſerious conſequences.

In a great proportion of caſes, perhaps in ninety nine of every hundred, the head of the femur when diſlocated is puſhed inwards and downwards, owing to the brim of the acetabulum being not ſo deep in this part as in others; while in fractures of the neck of the femur, the bone has in every inſtance that I have ſeen of it been drawn upwards, and the leg thereby rendered

dered ſhorter by three or four inches, in conſequence of the powerful exertion of the glutæi muſcles on a bone deprived of its ordinary ſupport. In all ſuch caſes, therefore, the trochanter is found to be much higher than the trochanter of the other thigh; and the knee and points of the toes turned inwards; while in thoſe diſlocations of the thigh-joint that I have mentioned, the leg is much lengthened, the head of the bone is found in the groin, and the trochanter is diſcovered on the fore-part of the thigh, while a correſponding vacancy is perceived where the trochanter and head of the bone ſhould be, and the toes are turned outwards.

In every fracture, a grating noiſe is diſcovered on the ends of the bone being rubbed againſt each other; and in all fractures of the neck of the femur, we obſerve, that the leg and thigh may be turned with much more eaſe from one ſide to another, that is, the knee and foot may be moved with more eaſe outwards or inwards, than when the head of the bone is diſlocated. I may likewiſe remark, that, in diſlocations, the tumor formed by the head of the bone and trochanter together, muſt always be larger than in fractures, where the tumor is formed by the trochanter alone.

In no part of ſurgery are practitioners more apt to be diſappointed than in the treatment of fractures of the thigh, particularly where the neck of the bone is broken. This proceeds from various cauſes; all of which ſhould be kept in view in forming a prognoſis of the event.

1. The thigh-bone is ſo thickly covered with muſcles and other ſoft parts, that it is often difficult to diſcover the direction in which a fracture runs.

2. We muſt often, therefore, be uncertain whether the bones are rightly replaced or not; for where the courſe of a fracture cannot be aſcertained, we can never be ſure whether this is rightly done or not.

3. But even where the reduction of the fracture can be accompliſhed, we know from daily obſervation that it is difficult

to retain the different parts of the bone in their ſituation with ſuch exactneſs as to prevent deformity. For when the fracture is either in the neck of the bone, or runs obliquely in any other part of it, it is ſo difficult to prevent the fractured parts of it from being diſplaced merely by the ordinary action of the muſcles, that the limb for the moſt part becomes much ſhorter than the other; for in all ſuch caſes, if the different parts of the bone cannot be ſo placed and retained as to ſupport each other, the under-part of it will very certainly be drawn upwards.

In all theſe fractures too, other cauſes concur to render it difficult to retain the fractured parts of the bone in their ſituation. They are more eaſily acted upon than fractures of other bones by every exertion of the body; particularly by ſneezing, coughing, and laughing; nor can the poſture of the body be in any way altered without moving the thigh.

Till of late, practitioners were often diſappointed in their endeavours to reduce fractures of the femur; chiefly owing to the poſition in which the limb was put during the operation. The body being placed either upon the floor, on a table, or in a bed, the limb was then extended, by which all the muſcles of the limb were put upon the ſtretch; and as the extenſion was continued till the different parts of the bone were replaced, when this was difficult, the muſcles were often either violently torn aſunder, or ſo much weakened as not to be afterwards fit for uſe; for ſome of the muſcles of the thigh being among the ſtrongeſt of the body, a very conſiderable force was required to overcome their reſiſtance. But if the muſcles of the limb are relaxed, by making the thigh form an obtuſe angle with the body while the joint of the knee is moderately bent, it is ſurpriſing with what eaſe we may, in moſt caſes, place the fractured end of the bone in its ſituation. The cauſe of reſiſtance is thus almoſt entirely removed; ſo that if much tenſion or ſwelling have not taken place, the ends of the bone may in general be eaſily brought in contact, by one aſſiſtant ſecuring the upper end of it, while the under part of it is ſupported and gently drawn down by another, the ſurgeon in the mean time being employed in putting the fractured parts together with as much accuracy as poſſible.

Fractures of the neck of this bone are particularly difficult to reduce; for the muſcles being here exceedingly ſtrong, and running in various directions, they cannot be relaxed ſo completely as thoſe in other parts of the limb. But even here we may, for the moſt part, ſucceed in the manner I have mentioned, the body being ſecured by one aſſiſtant, while moderate extenſion is made by another at the under-part of the thigh. Practitioners ought, however, to be provided with inſtruments for more powerful extenſion when more lenient meaſures do not ſucceed. Different inſtruments are delineated for this purpoſe in Plates LXXXVIII. LXXXIX. and XC., but none of them ſhould ever be employed till other more gentle means have failed.

It is not, however, in replacing the bones, but in retaining them when replaced, that we moſt frequently fail. In tranſverſe fractures of this bone, the practice is eaſy. After the fractured ends of it are brought in contact, they would for the moſt part ſupport each other with ſufficient firmneſs even without a bandage, if the patient ſhould be confined to a proper poſture; but to prevent any riſk from ſudden exertions, the parts ſhould be as firmly ſecured with ſplints and a proper bandage, as is conſiſtent with a free circulation through the reſt of the limb.

For this purpoſe two ſplints are repreſented in Plate LXXXI. fig. 4. and 6. One to reach from the top of the hip-joint to a little below the knee, and of a breadth ſufficient to cover at leaſt one half of the thigh; the other to reach from the groin to a little below the knee, and in breadth to cover about a third part of the thigh. Of theſe, covered with ſoft flannel, the longeſt laid upon a twelve-tailed flannel bandage, is to be placed upon a thin pillow nearly as long as the thigh. The patient being previouſly laid on a firm hair mattreſs ſupported by firm ſpokes of timber, ſo that the limb may not ſink or yield, his knee being moderately bent, and the bones accurately ſet, the pillow with the bandage and ſplint above it ought to be placed ſo that the ſplint may reach from the hip-joint along the outſide of the thigh to the knee. That this poſture of the leg and thigh may be eaſily preſerved, the patient ſhould not be laid directly upon his back, but turned ſomewhat towards the injured ſide; and the knee and leg raiſed rather higher than his body.

The limb being thus placed in the poſture in which it is to be kept, the ſhort ſplint mentioned above muſt be laid along the inſide of the thigh from the groin to the knee, when the twelve-tailed bandage, previouſly placed beneath the other ſplint, muſt be applied with ſuch tightneſs as to make an equal degree of preſſure over the whole thigh.

As the cure would be much interrupted, and might even at laſt be incomplete, were any part of the dreſſings to yield, it is a right precaution perhaps in every caſe, to inſert a long ſplint of firm timber beneath the pillow, and to ſecure it in its ſituation with two broad ſtraps firmly buckled on the upper part of the limb.

To obviate the motion of the limb, in conſequence of involuntary ſtartings, the pillow ſhould be fixed to the bed by ſtraps; and to prevent injury or uneaſineſs from the weight of the bed-clothes, two or three hoops fixed in a frame ſhould be placed over the thigh.

When no untoward ſymptoms occur, the limb might be left in this ſituation till the cure is complete; but leſt the bones ſhould by accident be diſplaced, and eſpecially if the limb ſhould ſwell and become painful, the bandage ſhould occaſionally be undone, and the upper ſplint removed, with a view to admit of the parts being accurately examined; and the twelve-tailed bandage admits of this, without diſturbing the limb. When pain, ſwelling, or much inflammation, ſupervene, it may be proper to apply leeches and other remedies to the injured parts; but when this does not happen, and when the bones remain in their ſituation, the ſplint ſhould be immediately replaced and ſecured with the bandage as before.

In healthy adults, when no interruption occurs to it, the cure is in general complete in the courſe of ſix weeks; but violent exertion of every kind ſhould be avoided till the eighth or tenth week has paſſed over.

I have adviſed the limb to be placed in ſuch a poſture as tends with moſt effect to relax the muſcles that belong to it. But although this may be highly proper at firſt, there is no neceſſity for the ſame poſture being continued during the whole courſe of the cure. It often indeed proves hurtful, as the limb, when kept invariably in one poſture for ſix or eight weeks, as is too frequently done, is very apt to become ſtiff and unwieldy, ſo as afterwards to give much uneaſineſs and diſtreſs. In a ſimple fracture, the patient may, at the end of a fortnight, be allowed to turn more towards his back, and the joint of the knee may be ſomewhat ſtretched out. If this is done with caution, it may be repeated daily; that is, the leg may be alternately ſtretched out and bent; by which the motion of the whole limb will be much more free and entire at the end of the cure than we uſually find it to be: but where the bones of a limb are broken in ſeveral parts, and into ſmall pieces, the limb ſhould not be raiſed nor moved in any manner of way till five or ſix weeks have elapſed; and then only with much caution.

In a great proportion of caſes in which cures are practicable, this courſe of treatment will prove ſucceſsful. It will never fail in tranſverſe fractures, if all the parts of it meet with proper attention: But although it will often ſucceed even where the bone is broken obliquely; yet it muſt be confeſſed, that caſes ſometimes occur in which it fails entirely; the ends of the bone ſlip paſt each other, and the limb becomes much ſhorter than it ought to be, notwithſtanding all our efforts to prevent it.

An effectual method, indeed, of ſecuring oblique fractures in the bones of the extremities, and eſpecially of the thigh bone, is perhaps one of the greateſt deſiderata in modern ſurgery. In all ages, the difficulty of this has confeſſedly been great; and frequent lameneſs produced by ſhortened limbs ariſing from this cauſe, evidently ſhows that we are ſtill deficient in this branch of practice.

The treatment of fractures being one of the moſt important branches of ſurgery, and to prevent lameneſs, one of our firſt objects, much ingenuity has been ſhown in the invention of means for anſwering this purpoſe: It has been propoſed, and by many attempted, in fractures of the thigh, to ſecure the patient's body, as one fixed point, with different bandages, to the upper part of the bed, and by an axis in peritrochio at the foot of the bed, to make ſuch a degree of extenſion as might be fully equal to the purpoſe of retaining the fractured bones. But all who are acquainted with the fretful, irritable ſtate, in which patients with fractures commonly are, and with the pain that tight bandages always excite, will know, that although propoſals of this kind may appear to advantage in theoretical diſquiſitions, they will never probably be of real utility. And accordingly none of them have ever been in general practice.

The invention of the late Mr Gooch of Norwich, is the one that promiſed to prove moſt uſeful in oblique fractures of the thigh. This inſtrument is delineated in Plate LXXXII., and in an improved ſtate by the late Dr John Aitken in Plate LXXXIII.

A broad firm ſtrap of leather, lined with quilted cotton or ſoft flannel, is placed on the upper part of the limb, where it is firmly ſecured with buckles. A ſimilar ſtrap is put round the under part of the thigh, and made to reſt chiefly on the condyles of the femur. Two or three ſteel ſplints, connected with the ſtraps, paſs from one to the other in ſuch a manner, that by means of them the ſtraps can be forced aſunder, and retained at any diſtance during the cure.

For a more particular account of this apparatus, the explanation of the Plates may be conſulted.

In ſome caſes, however, the pain, ſwelling, and inflammation, are ſo conſiderable, as to preclude the application of the moſt ſimple bandage. After theſe ſymptoms are relieved by local blood-letting and other remedies, Mr Gooch's method, or Dr Aitken's, may be adopted where the fractured bones cannot otherwiſe be retained; if not, the cure muſt be conducted in the uſual way, with the hazard of the ends of the bone paſſing each other, and of the limb being ſomewhat

what ſhortened. But in this event, under the circumſtances I have mentioned, although the patient may regret his misfortune, he cannot with juſtice blame the ſurgeon.

SECTION XIII.

Of Fractures of the Patella.

THE patella or knee-pan is liable to fractures from falls and bruiſes upon the knee. Tranſverſe fractures of this bone are moſt frequent: We alſo meet with longitudinal fractures, and in ſome caſes it is broken into three or four different pieces.

In fractures of the patella, we are deſired to make a guarded prognoſis; for by moſt writers, it is ſaid, that they almoſt conſtantly terminate in a ſtiff joint, owing, as is ſuppoſed, to the callus forming in too great quantity, and finding acceſs to the cavity of the joint. I have not found, however, that fractures of this bone are ſo apt to produce ſtiff joints as we are led to expect. In various caſes that have fallen under my care, ſcarcely any degree of ſtiffneſs remained after three or four months had elapſed; nor is it probable, when permanent lameneſs enſues to fractures of this bone, that it proceeds from ſuperabundancy of callus. I rather think that it proceeds from the inflammation that uſually takes place; or from the knee being kept too long in an extended immoveable poſture. From a dread of ſeparating the fractured parts of the bone before they are firmly united, the leg is uſually preſerved in an extended poſture for eight, or perhaps ten weeks; a much longer period than is neceſſary, and by which alone even the ſoundeſt joint would be apt to become ſtiff and immoveable.

In the treatment of fractures of this bone, in whatever direction they may run, the leg ſhould be extended, in order to relax the only muſcles with which it is connected, thoſe forming the ligament inſerted into it. With this view, the patient ſhould be placed upon a bed rendered ſo firm that it will not yield during the courſe of his confinement; a precaution highly requiſite in all fractures of the lower extremities, where long confinement to bed is almoſt always neceſſary, and where unequal ſinking of the body is often the ſource of much uneaſineſs to the patient, and may even be the cauſe of ſeparation of the newly replaced bones.

This being done, a long firm ſplint of timber, thickly covered with ſoft wool, or with ſeveral plies of fine flannel, ſhould be placed beneath the thigh and leg, from the upper part of the one to the extremity of the other; and to this the limb ſhould be ſecured by two ſtraps between the ankle and knee, and one or two between the knee and top of the thigh. This will effectually preſerve the leg in a ſtate of extenſion; and it does it in the eaſieſt manner when the ſplint is ſufficiently broad and properly covered with flannel and wool in the manner I have mentioned.

The different parts of the fractured bone are now to be brought as near together as poſſible with the hand; but no bandage is yet to be applied to them. Our great object at firſt is to prevent inflammation; for which purpoſe as much blood ſhould be taken from the joint with leeches as the patient can properly bear; and for two or three days, or as long as much pain, ſwelling, or tenſion, continue, ſaturnine and other aſtringent applications ſhould be uſed for removing them.

This being accompliſhed, we again examine the ſtate of the bone; and if the different parts of it are all either entirely or nearly in contact, they ought not to be diſturbed. The joint may be covered with a large pledget of ſaturnine cerate, by which it will be kept ſoft and eaſy; and a hooped frame ſhould be employed to ſupport the bed-clothes.

But if the different parts of the bone, inſtead of being nearly in contact, are found ſeparated to any conſiderable extent, we ought firſt to replace them, and then endeavour to retain them as far as this can be done with bandages.

In longitudinal fractures of the patella, this is eaſily done; for in this direction we meet with no reſiſtance, and the parts are eaſily retained by moderate preſſure, either with the common uniting bandage, or with ſlips of leather ſpread with glue or adheſive plaſter. But in tranſverſe fractures of this bone, as that part of it that remains connected with the extenſor muſcles of the thigh is apt to be drawn forcibly upwards, we cannot always replace it but with a force that would excite pain, ſwelling and inflammation.

It is not neceſſary, however, that the different pieces of bone be kept in exact contact. Where it can be eaſily done, it ought always to be adviſed; but I know from the reſult of ſeveral caſes where this was impracticable, that a cure may be obtained, and the joint be equally firm and uſeful as it was before, even although the ſeparated portions of bone cannot be kept within an inch of each other. We ſhould not therefore be anxious about this; and inſtead of uſing much force for drawing the bones into contact, no more ſhould be employed than the patient can eaſily bear.

Various bandages have been invented for drawing the divided parts of a fractured knee-pan together; but almoſt all of them have been formed upon erroneous principles. They are made to preſs equally upon the upper and under portion of the bone: Whereas the leaſt reflection on the anatomical ſtructure of the parts muſt render it obvious, that no advantage can be derived from much preſſure on the inferior part of the bone, which always remains in its natural ſituation; and therefore, that our force ſhould be entirely applied to that part of it that remains connected with the ligament of the extenſor muſcles, by the action of which, particularly of the rectus muſcle, this portion of the bone is drawn upwards.

In Plate LXXXIV. a bandage is repreſented, from which, while it fits eaſily upon the parts to which it is applied, every advantage may be derived that this kind of aſſiſtance can give: It conſiſts of two circular ſtraps of firm leather, A B, lined with ſoft flannel, with two perpendicular ſtraps C E, that paſs from one end to the other, and a ſemilunar firm compreſs G; with another ſtrap of a greater length D, reaching from the point of the toes to the buckle on the upper circular ſtrap round the thigh, as is more particularly repreſented in fig. 3. of the ſame plate.

The leg being extended and raiſed to a proper height for relaxing the extenſor muſcles of the thigh, the upper edge of the under circular ſtrap A ſhould be applied to the under part of the inferior portion of the bone, ſo as to ſupport it in its natural ſituation without forcing it farther up. The ſtrap muſt be then tightly buckled; and the upper half of the bone being pulled gently though firmly down, the ſemilunar compreſs F in fig. 2. muſt be applied round the upper end of it, when the upper circular ſtrap muſt be alſo buckled. By means of the two perpendicular ſtraps and buckles, we now make a gradual firm extenſion, which will not move the under circular ſtrap if it was previouſly made ſufficiently tight; but which will draw the other down if it has not been made too tight. This will, in ſome degree, draw down the upper part of the bone, by gently pulling the ſemilunar compreſs previouſly applied to the upper part of it; but it will be more effectually done by the ſtrap D made ſufficiently tight by fixing it to the correſponding buckle in the upper circular ſtrap B.

In this manner the different parts of the bone may be made to approach each other as far as this can with propriety be done; but for the reaſons I have given already, the preſſure ſhould never be carried ſo far as to endanger the excitement of pain, inflammation, or ſwelling.

The limb being ſecured in the manner I have mentioned, the bandages ſhould not be removed till the twelfth or fourteenth day, if pain and inflammation do not render a more early removal neceſſary. But about this period, the bandage ſhould be removed, when the limb may be moderately bent; and this being cautiouſly repeated every ſecond or third day, no interruption will be given to the cure, while the motion of the joint will be preſerved; which it ſeldom or never is when this piece of attention is omitted.

The joint of the knee is liable to another injury, ſo ſimilar in its effects, as well as in the method of cure, to fractures of the patella, that I think it right to mention it; namely, a ſeparation, by external violence, of the ligament or tendon of the rectus muſcle from the patella. The uſual effect of a ſmart ſtroke, or a ſevere fall, upon the fore-part of the knee, is a fracture of this bone; but where a perſon carrying a heavy burden upon his back, falls with his knee much bent, a rupture of the tendon more frequently happens: at leaſt I have met with it in ſeveral inſtances from this cauſe, in which the tendon, after ſeparating from the bone, retracted to the diſtance of two or three inches.

The treatment that I have adviſed for a fracture of the patella proves equally ſucceſsful here; only it will be underſtood, that in this caſe no advantage can be obtained from pulling down the retracted tendon: For not being connected with any part of the bone, it cannot be laid hold of; ſo that we have to truſt entirely to the extended poſture of the limb. But although the tendon and bone cannot be brought cloſe to each other, yet a cure may always be accompliſhed in the manner I have mentioned.

SECTION XIV.

Of Fractures of the Bones of the Leg.

IN fractures of the leg, only one bone is often broken; but a fracture of both is more frequent. In this caſe the ſeat, as well as the direction of the fracture, are readily perceived. When one bone only is broken, the nature of the injury is diſcovered with more difficulty. This, however, is of little importance; for when one of the bones remains entire, it ſerves ſo effectually to ſupport the other, that little more is neceſſary than confinement till the fractured bone is united.

Fractures are more frequent near the joint of the ankle than in other parts. A great proportion indeed of fractures of the fibula are ſeated an inch or two above the under extremity of this bone, this being the weakeſt part of it.

The ſame general principles that I have propoſed in the management of fractures of the thigh-bone, prove applicable in fractures of the leg: In replacing the bones, the muſcles of the limb ſhould be relaxed; and we do it in the moſt effectual manner by bending the joint of the knee, and ſlightly extending the foot. The leg being put in this poſition, the bones are for the moſt part eaſily replaced; and with no more extenſion than can be eaſily given by one aſſiſtant at the upper end of the limb, and another at the ankle.

This being done, and the patient placed in ſuch a manner that the injured leg may be laid upon its outſide, with the knee bent, the ſplints, figs. 3. 5. or 6. Plate LXXXI. ſhould be applied and retained with the twelve-tailed bandage; the ſplint on the outſide of the leg reaching from a little above the knee to beneath the ankle, with a view to prevent the motion of either of theſe joints, by which the bones are very apt to be diſplaced.

Whether the ſplints are of firm paſteboard, or ſuch as are repreſented in Plate LXXXI. they would, for the moſt part, prove ſufficient: But when the patient is either reſtleſs, or troubled with ſpaſmodic affections of the muſcles of his leg, an additional ſplint of wood, ſhaped to the form of the leg, repreſented in fig. 1. and 2. of the ſame plate, ſhould be applied along the outſide of it; and if it is ſlightly excavated and filled with ſoft wool or tow, it fits with eaſe, while it prevents, with certainty, the ends of any of the bones from falling down. We fix it with ſtraps and buckles, and the leg, when dreſſed in this manner, has the appearance repreſented in Plate LXXXV. fig. 2.

I have already obſerved, that after the dreſſings are applied, the leg ſhould be laid upon its outſide, with the knee bent, and the foot ſupported with a turn of a roller, as repreſented in the figure juſt mentioned.

ed. The intention of this is to relax the muſcles of the limb; by which the patient lies with more eaſe, while the bones are leſs liable to be diſplaced, than where the muſcles are fully ſtretched out, as till lately was almoſt the univerſal cuſtom.

But although the leg ſhould be placed in ſuch a poſture as may tend moſt effectually to relax the muſcles; yet the knee ſhould not be more bent than this requires: For when this joint is kept long much bent, it proves almoſt equally irkſome to the patient as when the leg is fully ſtretched out. The knee ſhould not therefore be more bent, nor ſhould the patient be laid more towards his ſide, than is juſt neceſſary for allowing the leg to be placed upon its outſide.

Some people, however, cannot ſleep when lying on either ſide; and ſome practitioners think, that fractures of the leg heal more eaſily when the patient is laid on his back, and the limb placed upon the gaſtrocnemii muſcles, with the toes upwards. In ſuch caſes the patient may be placed upon his back, and yet the curved poſition of the leg retained. This may be done in different ways; but the eaſieſt method is, to raiſe the leg, and ſupport it upon a frame, at a proper height above the level of the body. This admits of the limb being placed in the poſture I have adviſed, and with any neceſſary degree of curvature.

Even where a fractured leg is placed on the outſide, it proves to be a pleaſant variety to have the poſture altered; and with ſuch a frame it can be eaſily done.

A limb placed in this ſituation is repreſented in Plate LXXXVI. fig. 2., and the ſame varity of poſture is admiſſible in fractures of the thigh. The patient may from the firſt be placed with his leg curved in this manner; or he may afterwards turn upon his back, and the cure be completed while he remains in this poſture, or he may alternately change from one to the other. The inconveniency uſually complained of, from the leg reſting upon the heel when ſtretched out, is avoided by an excavation or opening in the bottom of the frame for receiving the heel, or it may be done by allowing the heel to project over the edge of the frame altogether. No change of poſture, however, ſhould be permitted for the firſt ten or twelve days. About this time the patient may be turned with caution upon his back, and the leg moved from one poſition to the other, care being taken to preſerve it in the ſame degree of curvature.

In fractures of the leg, where the fibula only is injured, it is apt to paſs unnoticed, and to be conſidered as a ſprain of ſome of the muſcles: But as very ſerious conſequences are apt to enſue from this miſtake, it ought to be ſtrictly guarded againſt.

When treating of fractures of the clavicle, I had occaſion to mention an appearance which, of itſelf, is extremely ſimple and of eaſy treatment; but which, from want of attention to the cauſe of it, has often been productive of much perplexity both to patient and practitioners;

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I mean what is commonly termed the Riſing End of a Bone; and as this frequently occurs in the leg, I think it proper to mention it here.

When the bones of the leg are broken directly acroſs, they ſometimes ſerve to ſupport each other ſo effectually that neither of them are diſplaced. In ſuch circumſtances, no inequality appears in the limb, if it be not from ſome temporary ſwelling of the ſoft parts. But when both bones are not only fractured but diſplaced, the under part of them, or that portion connected with the foot, is almoſt always drawn down, and towards the back part of the leg; by which an unequal prominency is produced by the projecting end of the upper portion of bone, or that part of it which ſtill remains connected with the knee.

It is this that is termed the Riſing End of the Bone; and in reducing ſuch fractures, much pains is commonly taken to force this part of the bone into contact with the other. It is obvious, however, that the upper part of the bone does not riſe, but that the inferior portion falls, or is drawn down, and out of its natural ſituation, by the weight of the foot, as well as by the contraction of the muſcles on the back part of the leg: Hence no advantage can be gained by any preſſure made upon the ſuperior part of the bone, while much harm is often done by it, by bandages being ſo tightly tied over it as to cut all the teguments with which it is covered; and thus forming a compound fracture of what otherwiſe would have remained of the moſt ſimple kind.

The upper part of the bone never riſes out of its natural ſituation; ſo that any inequality in the form and appearance of the leg, muſt be produced in the manner I have mentioned, namely by the inferior portion of the bones being drawn out of the ſituation which they ought to occupy: So that inſtead of forcing down the upper part of the bone, our ſole object ſhould be to raiſe the inferior part of it, ſo as to bring them into contact; and by ſupporting it in this ſituation, to endeavour with as much certainty as poſſible to effect their reunion. In this manner a cure may be often accompliſhed, which could not be obtained in any other way.

SECTION XV.

Of Fractures of the Bones of the Foot and Toes.

FRACTURES of the bones of the foot and toes are to be managed nearly in the ſame manner with ſimilar injuries of the hands and fingers. All portions of diſplaced bone muſt be put into its natural ſituation with as much accuracy as poſſible; and we endeavour to retain them by ſplints fitted to the form of the part, ſupported with different turns of a roller. In fractures of the bones of the foot, a large ſplint ſhould be applied over the ſole, ſo as to ſupport the whole of it; and no freedom ſhould be permitted in the motion either of the foot or ankle during the cure; for nothing tends more to diſplace a fractured portion of bone than the action of the contiguous muſcles.

SECTION XVI.

Of Compound Fractures.

AS the term Compound Fracture has been applied to injuries of different kinds, I think it right to define with preciſion the meaning that I wiſh to affix to it. A fracture of a bone, communicating with an external opening or wound in the correſponding teguments, I denominate a compound fracture. It is not the circumſtance of a fractured bone being accompanied with a wound in the contiguous ſoft parts, that conſtitutes a compound fracture: This may happen with a fracture of the moſt ſimple nature. Unleſs the external opening communicates with the fracture of the bone, the fracture is not affected by it, even although the wound is extenſive; while the ſmalleſt puncture paſſing directly to the ſubſtance of a fractured bone, adds difficulty to the method of cure, and hazard to the event.

Compound fractures are produced, not only by external violence, but frequently by the bones in ſimple fractures being, in the courſe of the cure, puſhed through the correſponding teguments. In ſome caſes, this happens from a bone being ſo very obliquely fractured that it terminates in a ſharp point; while in others it is the evident effect of too tight a bandage, applied with the view, as we have ſeen in Section XIV., of bearing down the upper end of the fractured bone. But in whatever way a compound fracture is produced, the conſequences that reſult from it are nearly ſimilar. The admiſſion of air to a fracture adds evidently to the riſk that attends it; and whether this takes place as an immediate effect of external violence, or as the conſequence of preſſure upon the ends of the bone, no difference is perceived in the effects that reſult from it.

Various reaſons might be adduced to prove that it is the admiſſion of air alone that renders compound fractures more hazardous than others. I may ſhortly mention, however, one of the moſt obvious proofs of it. The worſt variety of ſimple fracture, where the bone is broken in the moſt oblique manner, and where it is difficult or perhaps impoſſible to retain it in its ſituation, will continue to do well, and to excite no ſevere ſymptom, as long as the ſkin remains entire: But if, by any accident, the point of the bone is puſhed through the teguments, from that moment the pain becomes more ſevere; the inflammation, which before perhaps was trifling, becomes now conſiderable; fever takes place; the limb is apt to be attacked with ſevere ſpaſmodic twitchings; and to theſe gangrene or extenſive ſuppurations frequently ſucceed.

In the treatment of compound fractures, our firſt object is to reſtrain profuſe hemorrhagies when they take place, by a proper application of the tourniquet:

Our next is to conſider, whether we ſhould attempt to ſave the limb, or recommend immediate amputation.

From the difficult treatment and uncertain event of compound fractures, practitioners have been very univerſally diſpoſed to conſider the amputation of the fractured limb as neceſſary. At all times indeed individuals have oppoſed this general opinion. Among others, Mr Bilguer of Berlin wrote decidedly againſt it; and he aſſerts, that amputation is ſeldom or never neceſſary, and that a greater number of patients would recover if this operation were entirely exploded.

To me it appears that both opinions are in the extreme; and that they have been formed without that attention to the diſcrimination of circumſtances which the great importance of the queſtion merits.

In private practice, where patients can be kept quiet and perfectly at reſt from the date of the injury, and where due attention can be enſured on the part of the practitioner, as well as of experienced nurſes, compound fractures ſhould receive a different treatment from thoſe that happen in a field of battle or in an engagement at ſea. So many inſtances occur, in which, from amputation being objected to by the patient, from the limb being too much ſwelled or inflamed before aſſiſtance is called, or from intention on the part of the practitioner to endeavour to ſave the limb, of cures being made, that I am now convinced that in private practice immediate amputation ſhould never be adviſed, unleſs when the bones are ſo much ſhattered that they cannot reunite; or where, from the violence of the injury, the texture of the ſoft parts is completely deſtroyed.

On the other hand, I believe, that it would be a good general rule, both in the navy and army, to amputate immediately in all caſes of compound fracture that occur in battle, where the accident is either in the humerus or thigh, or where both bones of the fore-arm or leg are fractured. In this ſituation, the patient is expoſed to a variety of hardſhips that tend to aggravate his danger; while no accommodation can be procured nor attention given to leſſen it.

In oppoſition to this it may be alleged, that compound fractures are frequently cured in military hoſpitals. This indeed is the argument on which Mr Bilguer reſts his opinion: But, like every prejudiced inquirer, he ſtates it partially.

I readily admit, as every one accuſtomed to the treatment of fractures will do, that cures are ſometimes unexpectedly accompliſhed under the moſt untoward circumſtances; but the favourable termination of a few caſes will never invalidate an eſtabliſhed practice, founded on the ſure baſis of experience and obſervation.

When an officer of rank and fortune receives a compound fracture, and where circumſtances admit of his being ſoon conveyed to good quarters, with a proſpect of this being his place of reſidence during the cure, the caſe muſt be bad indeed if we do not attempt to ſave the limb. But this does not happen in the uſual routine of military practice; and I mention ſuch caſes only, becauſe the accounts we have received of Mr Bilguer's ſucceſs, are chiefly, if not entirely, drawn from ſuch inſtances; and they therefore afford no general concluſion relative to military and naval practice.

Even in private practice, I am far from thinking that our attempts to ſave fractured limbs will always ſucceed. I know that they do not; and, in the courſe of much buſineſs, caſes ſometimes occur in which the beſt conducted meaſures fail, particularly where the large joints are injured, and where the long bones are not only fractured but ſplintered in different places: But I alſo know from experience, that where at laſt we are obliged to adviſe amputation, more recover when the operation is delayed, than commonly do where it is performed ſoon after the accident; at leaſt this has been very commonly the caſe in the courſe of my obſervation,

ſervation. Of thoſe who have died ſoon after the operation, either from the fever induced by the extenſive wound; from the great and ſudden change produced in the circulating ſyſtem by the removal of a limb; or from the perturbation and violent agitation of ſpirits which the unexpected loſs of a limb muſt always induce, a great proportion has been of thoſe on whom the operation was performed immediately after the accident: A patient in this ſtate of body and mind muſt be ill-fitted for undergoing the ſeverity of ſuch an important operation; and accordingly all the cauſes that I have enumerated concur to render the ſubſequent fever, and every concomitant ſymptom, more violent than we commonly find them in patients who have been reduced by confinement and a low regimen, and who, from having full leiſure to reflect upon the danger of their ſituation, are, from their own conviction of the neceſſity of the meaſure, very readily induced to ſubmit to the operation.

A patient may indeed be brought ſo low as to make the ſucceſs of the operation doubtful from this cauſe alone: But a practitioner may always guard againſt this, by propoſing the operation as ſoon as his attempts to ſave the limb prove abortive, and before the patient's ſtrength has declined too much.

Amputation ſeems to prove more ſucceſsful in the more advanced ſtages of compound fractures than immediately after the accident; and ſtill more ſo in the advanced ſtages of chronic affections, particularly in white ſwellings of the joints, as I have elſewhere remarked, than in the more early periods of the diſeaſe. A point of the greateſt practical importance is thus offered to our conſideration. So far as my obſervation goes, I conſider the fact as aſcertained; and if the experience of others leads to the ſame concluſion, it will prove the moſt convincing argument againſt early amputation. In the courſe of my own experience, I do not recollect an inſtance of death having enſued from the operation alone, where the diſeaſe was of ſome duration for which it was adviſed; and it has often been performed where the patient was greatly exhauſted: Whereas many have died merely from the operation, where it has been put in practice ſoon after the accident. When I ſpeak of death as the conſequence of the operation, I do not mean ſuch inſtances of it as occur from hemorrhagies breaking out in the courſe of a ſhort time after the patient is laid in bed, as theſe commonly happen from negligence on the part of the ſurgeon, at whatever period a limb may be amputated; but ſuch as take place about the ſecond or third day, and in ſome inſtances at a later period, from the violence of the fever induced by and commencing ſoon after the operation.

When amputation is not performed immediately, or ſoon after the injury is received, all practitioners agree that it cannot, for ſeveral days at leaſt, and often for a much longer period, be admiſſible.

Different cauſes may afterwards render it neceſſary.

1. Hemorrhagies under certain circumſtances.

2. Extenſive mortification.

3. The ends of the fractured bones remaining long diſunited, while a copious diſcharge of matter endangers the ſtrength of the patient.

When hemorrhagies take place immediately, we have it always in our power to command them, either by compreſſion alone, or by enlarging the wound when it is too ſmall, and ſecuring the bleeding arteries with ligatures. Sometimes, however, when no diſcharge of importance occurs at firſt, profuſe hemorrhagies will take place at the end of ſeveral days. It may be difficult in ſome caſes to account for this; but we can frequently trace it to the effect of friction; the coats of an artery being deſtroyed by beating or rubbing upon the ſharp edge of a ſplintered bone.

Even in this advanced ſtate of the injury, we may frequently be able to ſecure the wounded arteries with ligatures. But the limb is ſometimes ſo much ſwelled and inflamed before the hemorrhagy appears, that the original opening will not admit of this; and on proceeding to enlarge it, ſuch confuſion is met with from effuſed coagulated blood between the interſtices of the muſcles, as well as through the whole cellular membrane of the affected parts, that the divided arteries cannot be all brought into view, but by ſuch extenſive inciſions as in this ſtate of the parts would create more hazard than amputating the limb at a proper diſtance above: And although it is not frequent, yet inſtances happen, where the moſt expert ſurgeons are obliged in this ſituation to amputate.

Mortification is perhaps the moſt urgent motive for amputating in this ſtage of compound fractures. I ſhall have occaſion, however, to conſider this ſubject more particularly in the chapter on amputation;

putation; and with reſpect to the third cauſe that I have mentioned, no reunion taking place between the fractured parts of the bone, and a ſinking of the patient's ſtrength from too copious a diſcharge of matter, no practitioner of experience will, in this ſituation, diſpute the propriety of amputation.

It is this ſtate of a compound fracture, when the original inflammatory fever excited by the injury is gone, and before the patient is too much weakened by the diſcharge, which of all others I conſider as the moſt favourable for amputation. The exact time cannot poſſibly be fixed by any general obſervation: It muſt depend upon the particular circumſtances of every caſe, and chiefly upon the quantity of the diſcharge, and ſtrength of the patient; and theſe again are points which the judgment of the practitioner in attendance can alone decide upon. I may remark, however, that, as long as the patient does not ſeem to be much hurt by the diſcharge, however great it may be, the operation ſhould not be adviſed; for, while his ſtrength is not much impaired, we may with ſafety proceed in our endeavours to ſave the limb.

From what has been ſaid, it will appear, that in private practice, very few caſes can occur of compound fractures, in which we ſhould not attempt to ſave the limbs.

In the treatment of compound fractures, our object is the ſame as in the management of thoſe of the moſt ſimple nature; namely, to replace the bones that may be deranged, and to retain them till they are united.

In the firſt place, all extraneous bodies ſhould be removed, as well as all thoſe ſmall pieces of bone that will not probably unite with the reſt; for which purpoſe, the opening, if too ſmall to admit of their being eaſily taken out, ſhould be enlarged with a ſcalpel. And this being done, we in general find, that the bones are eaſily replaced by relaxing all the muſcles of the limb in the manner already pointed out in the preceding ſec-

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rions of this chapter. Only one exception occurs to this: A ſharp point of a bone is, in ſome inſtances, ſo far puſhed through the teguments, that it cannot be replaced by an ordinary force; and to a certain extent, the greater the force is that we apply, the more firmly the protruded portion of bone is fixed between the ſkin and parts beneath. In this ſituation, we ſhould either ſaw off the end of the protruded portion of bone, or enlarge the wound.

When a long ſharp point of bone is much protruded, we ſhould not heſitate to remove it; for, although it might be reduced, it would not readily unite with the reſt of the bone, at the ſame time that it would be apt to excite much pain and irritation. When the portion to be taken away is ſmall, it may be done with the cutting forceps uſually employed in amputations: But, when it cannot be eaſily done in this manner, it may with ſafety be taken off with a ſaw; a piece of paſteboard, or thin ſheet-lead being previouſly inſerted between it and the teguments beneath.

But when the protruded portion of bone is broad at the baſe, and not of great length, as there will be cauſe to hope that it may unite with the reſt of the bone if the correſponding parts are brought in contact, we ought certainly to endeavour to ſave it; and in general we are able to do ſo by enlarging the opening through which it has paſſed. If we take care to avoid any large bloodveſſels and nerves, which thoſe acquainted with the anatomy of the parts will readily do, no danger will occur from the operation. Inſtead of increaſing the danger of the patient, it tends often to leſſen it, by removing a powerful cauſe of pain and irritation, and thus preventing that inflammatory tenſion to which limbs in this ſituation are particularly liable.

To thoſe not accuſtomed to manage compound fractures in this manner, the practice that I now recommend may be ſuppoſed to be attended with hazard; and to convert a ſmall puncture into an extenſive wound, may often appear to be cruel and unneceſſary. But as the admiſſion of air has already occaſioned all the miſchief that can ariſe from this, we do not in this manner add to the hazard of the patient; and it is generally well known, that a free inciſed wound heals more readily than a ſmall puncture. It is the ſkin only that for the moſt part we have to cut here; but even where the bone cannot be eaſily reduced without carrying the inciſion into the ſubſtance of the contiguous muſcles, we ſhould not heſitate to adviſe it: Only, in this caſe, the opening ſhould be made as much as poſſible in the direction of the fibres of the muſcles.

The ſplinters of bone, coagulated blood, and other extraneous bodies being removed, any artery that may be cut being ſecured with a ligature, and the protruded portion of bone replaced, the fracture is, in other reſpects, to be reduced in the manner I have adviſed when ſpeaking of ſimple fractures; that is, by relaxing the muſcles of the limb, and extending the bones no more than is juſt neceſſary. This being done, a pledget of ſoft lint, ſpread with any emollient ointment, ſhould be laid over the wound, when the limb ſhould be placed upon a firm ſplint, and ſtill kept in a relaxed poſture. As it is of much importance that the wound be regularly dreſſed without moving the limb, it ſhould, if poſſible, be ſo placed, that this can be done; and with the ſame view, the twelve-tailed bandage, in compound fractures of the extremities, ſhould be preferred to the roller.

As it is a point of the utmoſt importance to place the limb in ſuch a poſture as will admit of the ſore being dreſſed without being moved, various inventions have been propoſed for rendering this in every caſe practicable. Few of theſe, however, have anſwered the purpoſe for which they were intended. The beſt that I have ſeen is a box invented by the late ingenious Mr James Rae of this place; of which, with ſome improvements made by his ſon Mr John Rae, I now give a delineation. The leg may be laid in it either bent or ſtraight, and a wound, wherever ſituated, may be dreſſed without altering the poſition of the limb, as will be more clearly underſtood from the repreſentation of the inſtrument, Plate LXXXIII. fig. 3.

In whatever ſituation the limb is placed, it is an object of the firſt importance to endeavour to prevent inflammation; for, when mortification enſues, it may be almoſt always traced to a high degree of inflammation; and to this alſo may be traced thoſe extenſive collections of matter which often occur in compound fractures. We are, therefore, from the firſt, to guard againſt the acceſſion of this ſymptom; by one or more general bloodlettings, proportioned to the ſtrength of the patient; by the application of leeches to the edges of the ſore; by the uſe of opiates; by gentle laxatives; a low regimen; and other parts of an antiphlogiſtic courſe. The dreſſings ſhould be removed once or twice daily, according to the quantity of matter; and inſtead of dry lint, pledgets of any emollient ointment, or Goulard's cerate, ſhould be preferred; for I have not found in any ſtate of theſe ſores that ointments do harm; and they always ſit eaſily, and are more eaſily removed than when dry lint is applied alone.

Warm emollient poultices are commonly applied at firſt, and continued for a good many days; but as they prove always troubleſome, and cannot be removed without in ſome degree altering the poſture of the limb, I think it better to avoid them till we ſee whether or not they become neceſſary by the approach of inflammation. In that event, they ſhould be immediately employed as the ſureſt means of exciting a diſcharge of matter: For, although we would rather wiſh the ſore to heal by what is termed the Firſt Intention, without the formation of matter; yet this being a rare occurrence in wounds attending compound fractures, and a plentiful diſcharge of good pus being the moſt certain preventive of mortification, we ſhould not heſitate in our endeavours to promote it whenever the inflammation becomes ſevere.

As ſoon, however, as our views are accompliſhed, by the inflammation ſubſiding, and a free diſcharge of matter having taken place, the poultices ſhould be laid aſide: for when too long continued, they certainly do harm, by relaxing the parts too much, and exciting too profuſe a diſcharge.

When matter is diſcharged from compound fractures in too great abundance, beſides laying aſide the uſe of emollient poultices, the ſore ſhould be dreſſed with aſtringents, ſuch as ſoft lint dipped in a ſolution of ſaccharum ſaturni, with a due proportion of brandy; and the patient ſhould be ſupported with nouriſhing food, a free uſe of wine, Peruvian bark, and elixir of vitriol. A free vent ſhould be procured for the matter; and when this cannot be obtained by the poſture of the limb, it ſhould be done by making a counter opening in a more depending part. The neceſſity, however, of this, may be often prevented by employing ſoft lint, or covering the ſore with ſoft ſponge to abſorb the matter, and by frequent dreſſings; for, although the ſores ſhould never be more expoſed to the air than is neceſſary, yet whenever the diſcharge is copious, there will be more riſk from allowing the parts to be long immerſed in matter, than from a frequent renewal of the dreſſings.

When the diſcharge from compound fractures is exceſſive, and cannot be leſſened by the means I have mentioned, it will often be found to proceed from a portion of looſe bone that has not been earlier noticed. In this ſituation, we ſhould examine the ſore with as much attention as poſſible; and wherever a piece of looſe bone is diſcovered, it ought to be taken out either at the ſore itſelf, or by a counter opening, if it appears that in this manner it can be more eaſily done. In making an examination for this purpoſe, the finger alone ſhould be employed when the opening is ſo large as to give it acceſs; for in this manner we do leſs harm than with a probe; and at the ſame time we diſcover the real ſtate of the parts with more preciſion. When it is neceſſary to uſe a probe, it ſhould be done with caution, for much miſchief is frequently done where probes are uſed with freedom.

If, inſtead of producing a diſcharge of matter, the inflammation ſhould end in gangrene, the hazard becomes ſtill greater than it ever can be from the moſt extenſive abſceſs. Having already in Chapter I. conſidered the ſubject of gangrene, I muſt now refer to that part of the work. In a following chapter, I ſhall have an opportunity of mentioning the period at which amputation of limbs, attacked with gangrene, ſhould be adviſed.

In conſidering this ſubject, ſome will ſuppoſe that I ſhould have given more particular directions for ſecuring fractured limbs in their ſituation, eſpecially in compound fracture; but, as I know of no method of effecting this with ſuch certainty and eaſe as the one that I have deſcribed, I conſider it as unneceſſary to enumerate all the means that have been propoſed for it. In particular circumſtances, thoſe that I have deſcribed in the eleventh ſection of this chapter, the machines of Mr Gooch, and Dr Aitken, may prove uſeful for keeping the fractured bones extended; and much advantage may certainly be derived from them in giving a ſteady ſupport to fractured limbs, when it is neceſſary to move a patient from one part to another: But in common practice, I can without heſitation ſay, that no advantage is derived from any inſtrument of this kind that I have ever known uſed; and few, I believe, have paid more attention to this branch of buſineſs than I have often had occaſion to do.

CHAPTER XL.

Of LUXATIONS.

SECTION I.

General Remarks on Luxations.

A Bone is ſaid to be luxated where that part of it forming a joint is diſplaced. When the end of a bone is forced entirely out of its correſponding cavity, the diſlocation is ſaid to be Complete; and we term it incomplete, where any part of the bone reſts upon the edge of the ſocket.

Luxations may, with the ſame propriety as fractures, be divided into ſimple and compound. Where the end of a bone is merely diſplaced, we term it a Simple Luxation; but where this is accompanied with a correſponding wound in the ſoft parts, laying open the cavity of a joint, we ſay that the Luxation is Compound. By ſome practitioners the term Compound is applied to diſlocations accompanied with fractures of the contiguous bones, whether the teguments be injured or not. We ſay, however, with more propriety, that a luxation in ſuch circumſtances is of a Complicated Nature.

For the moſt part luxations are produced by external violence, and appear as the immediate conſequences of ſome conſiderable force applied to the injured parts. They are particularly apt to occur in leaping and falling; from blows, and from violent twiſts and diſtractions of the different bones of a limb: But they are alſo produced by other cauſes; by a morbid weakneſs or relaxation of the ligaments and muſcles of a joint, which ſometimes occur as the conſequences of palſy and long-continued rheumatiſm; and by the end of a bone being puſhed from the cavity in which it was lodged, by matter collected in it, or by tumors and exoſtoſes.

Diſlocations produced by external violence, are chiefly the objects of ſurgery. The ſymptoms uſually induced by theſe, are, inability to move the injured limb; pain, tenſion, and deformity in the part affected; and in ſome caſes inflammation, ſubſultus tendinum, and fever.

In general, the motion of the limb is impaired in proportion to the extent of the luxation; but in ſome caſes, even the moſt partial luxation renders the joint perfectly ſtiff and immoveable, and creates the moſt exquiſite pain on every attempt to move it. This is particularly the caſe in partial diſlocations of the large joints.

The deformed or altered appearance of a joint, with which luxations are always accompanied, muſt neceſſarily be in proportion to the extent of the injury; but this is not the caſe with the other ſymptoms: For ſubſultus tendinum, inflammation and fever, are often excited in a greater degree by partial diſlocations, where the ends of bones are not much moved from their ſituation, than where they are entirely forced from their ſockets, owing to a circumſtance that we ſhall preſently endeavour to explain.

The firſt approach of ſwelling in diſlocation, is always of the inflammatory kind, and it is a neceſſary effect of the violence done to the injured parts. This, however, ſhould be diſtinguiſhed from a ſecondary ſwelling to which diſlocations are liable, an extenſive tumefaction that in ſome caſes ſpreads over all the under part of the limb, and which ſeems to originate from a different cauſe. Inſtead of being red, tenſe, and painful, the teguments are pale, ſoft, and œdematous; owing,

ing, I ſuppoſe, to the lymphatic veſſels of the limb being compreſſed by the end of the diſplaced bone. This kind of ſwelling is moſt frequent in diſlocations of the femur and humerus; in which alſo conſiderable numbneſs or diminiſhed ſenſibility is apt to take place from the compreſſion of the nerves of the limb.

It is of much importance to diſtinguiſh diſlocations from other affections of the joints, and to aſcertain to what extent the bones are moved from their ſituation. In compound luxations the nature of the injury is obvious; and, for the moſt part, it is ſufficiently evident where bones are completely diſlocated; but partial diſlocations are often not to be diſcovered but by the moſt minute examination: They therefore frequently paſs unnoticed, or are conſidered as ſprains, and contuſions; and thus, where, with due attention on the part of the practitioner, a cure might frequently be performed, patients are often rendered lame and miſerable for life.

The ſymptoms that I have enumerated are common to all diſlocations. In ſpeaking of particular luxations, I ſhall have occaſion to mention the peculiarities of each, and I ſhall endeavour to do it in ſuch a manner as may with moſt certainty prevent thoſe unfortunate occurrences to which I allude.

In forming a prognoſis of the event of luxations, that is, of the practicability of their reduction, and of the termination of the ſymptoms with which they are attended, various circumſtances require attention: The form and ſtructure of the different joints; the nature and extent of the luxation, together with the degree of violence by which it was produced, and the circumſtances with which it may be complicated; and, laſtly, the duration of the injury.

The ſkeleton is commonly had recourſe to for a knowledge of the joints; but although every ſtudent ſhould be acquainted with the articulations in a dry ſtate, we ſhould by no means reſt ſatisfied with this. In the treatment of luxations, it is much more neceſſary to have an exact knowledge of the joints in a recent ſtate; of the cartilages, ligaments, and tendons, with which the bones are connected, as well as of the contiguous parts in which the heads of the diſplaced bones may happen to be lodged: Otherwiſe our ideas of the nature of theſe injuries, and of the means that will moſt probably prove ſucceſsful in the reduction of diſplaced bones, muſt be very imperfect.

I cannot here enter upon a minute deſcription of every joint, as it would lead to an extent of diſcuſſion inconſiſtent with the nature of this work. Referring to the proper ſources for more particular information, I ſhall here only obſerve, that it is chiefly thoſe joints that are poſſeſſed of much motion in which we meet with luxations. Of theſe, there are two varieties. The one termed the Junction by Ball and Socket, where the head or end of one bone is received into the cavity of another; and the other termed by anatomiſts Ginglimus, or the Hinge-like Joint, from its reſemblance to the hinge of a door. In this the joint is formed by different parts of one bone being received into cavities or indentations of another. The former admits of the moſt extenſive motion, as is exemplified in the joint of the humerus with the ſcapula, and in that of the femur with the oſſa innominata; while the latter does not admit of more than that of flexion and extenſion, as is the caſe in the elbow and knee. In theſe we accordingly find, that this more limited motion to which they are confined, renders them leſs liable to luxations; while the free motion of the others expoſes them to be frequently luxated, as is more particularly the caſe in the joint of the humerus, from the cavity in which the head of that bone is lodged being of no great depth.

Beſides the uſual coverings of teguments, muſcles, and tendons, in common to joints with the reſt of the body, every joint poſſeſſed of much motion is provided with what is termed a Capſular Ligament; which is a firm ſomewhat elaſtic ſubſtance, forming a kind of pouch or bag, that completely ſurrounds the articulation, and ſerves at the ſame time to retain the ends of the bones together, and to contain a thin tranſparent fluid, the ſynovia, for the purpoſe of lubricating the cartilages that cover the ends of the bones.

Practitioners are not agreed whether in luxations the capſular ligaments of joints are ruptured or not. As it has appeared on diſſection, in a few inſtances, that the ligament was ruptured, ſome have concluded that it is the caſe in all; while others are of opinion, that the ligament always remains entire, except where the luxation has been the conſequence of very ſevere and unuſual degrees of violence.

The reſult of my obſervation on this point is, and I ſpeak from many opportunities of diſſecting diſlocated joints after death, that partial luxations may happen without any rupture of the capſular ligament; but that it is always ruptured in complete luxations produced by external violence; nay, that the ligament is often torn from its inſertion round the neck of the bone. Where the head of a bone is gradually puſhed from its ſocket by the ſlow formation of a tumor within the joint, and where the ligament is perhaps much relaxed by diſeaſe, a luxation may happen without either rupture or laceration: But we cannot ſuppoſe that ſuch a firm ſubſtance as a ligament in a ſtate of health always is, will, without burſting, yield to the ſudden impulſe produced by the complete diſlocation of the head of a bone, and where the diſplaced bone is in ſome caſes almoſt inſtantaneouſly forced to the diſtance of ſeveral inches from its natural ſituation. Different inſtances are upon record of this opinion being ſupported by the diſſection of diſlocated joints after death; and were it neceſſary, I could add ſeveral others that have fallen within my own obſervation.

I mentioned above, that the pain attending partial diſlocations is commonly very ſevere on every attempt to move the joints. For the moſt part, indeed, it is more exquiſite than it uſually is where the luxation is complete; and we conclude that it proceeds from the capſular ligament being overſtretched, and from the ends of the diſplaced bones continuing to act againſt it inſtead of paſſing freely through it.

In judging of a luxation, the diſtance to which the head of the diſplaced bone is forced, and the degree of violence by which it was produced, require particular attention. When a bone is only partially diſlocated, although the pain may be very acute, yet the reduction will be accompliſhed both with more eaſe and certainty than if the ſame bone had been forced completely out of its ſituation. And where the joint has not ſuffered any extraordinary violence, the inflammation and other concomitant ſymptoms will not prove ſo formidable as they commonly do where the capſular ligament and other ſoft parts have been much ſtretched, or otherwiſe ſeverely injured.

One of the moſt unfavourable circumſtances with which a luxation is ever attended, is a fracture of one or both of the bones forming the joint. Even a fracture of the diſplaced bone proves always diſtreſsful, eſpecially if it is broken near to its neck, as in this caſe it can ſcarcely be laid hold of for the purpoſe of reducing it; but the riſk attending it is much greater when the bone forming the ſocket into which it ſhould be received is alſo broken: For we know from experience, that fractures of theſe parts are more apt to excite ſevere degrees of inflammation, as well as extenſive ſuppurations, than fractures of any of the long bones. And when the ſocket is broken, there is always much hazard of the joint being rendered ſtiff for life, even when the reduction of the diſplaced bone is accompliſhed in the eaſieſt manner.

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A diſlocation being more or leſs recent, is the next point that merits attention; for we know that luxated bones are, cæteris paribus, more eaſily reduced ſoon after being diſplaced than when much time has elapſed. While the injury is recent, the bone returns with more eaſe along the parts which it has juſt traverſed, than it poſſibly can do after lodging ſeveral weeks or months among the contiguous muſcles; where the head of it, inſtead of being looſe, as is uſually the caſe at firſt, forms a ſocket for itſelf, and is commonly firmly graſped by ſome of thoſe muſcular fibres with which it is ſurrounded. At this period too, the cavity from whence it was diſlodged may probably be in ſome degree filled up by the contiguous ſoft parts: Not that the ſynovia ever becomes inſpiſſated, ſo as to produce this effect; for although this has by many been ſuppoſed to happen, and various means have been propoſed for preventing and removing it, yet we now know that the opinion is ill-founded. No inſpiſſation of this fluid has ever been diſcovered by diſſection, although ſtiff joints, where this ſtate of the ſynovia was previouſly conſidered as the cauſe, have often been laid open for the purpoſe. But although the cavity of a joint may not be filled up by the effect of any particular affection of the ſynovia, there is much reaſon to ſuppoſe, that in courſe of time it will be diminiſhed by the conſtant action of the contiguous muſcles; which will not only force the cellular ſubſtance, fat, and other ſoft parts with which it is covered, into it, but may even have ſome effect in compreſſing the bone itſelf, or the cartilaginous brim with which the bone is uſually covered.

Theſe are the circumſtances in diſlocations which more particularly require attention; but we have alſo to remark, that the patient's age and general ſtate of health, have ſome influence in the reduction of a diſlocated bone. Diſlocations are more eaſily reduced at ſome ages, and in particular habits of body, than in others. Thus, in advanced periods of life, and in weak delicate conſtitutions, where the muſcles give little reſiſtance, diſplaced bones are more eaſily moved than in the vigour of youth, and in robuſt habits of body, where the ſuperior ſtrength of the muſcles has a conſiderable effect in preventing it.

In the treatment of diſlocations, the objects we have in view are, to put the bone that is diſplaced into its natural ſituation, with as much eaſe and expedition as poſſible; to retain it in this ſituation till the injured parts have recovered their tone; and to obviate pain, inflammation, and any other ſymptom that requires attention.

Before proceeding to the reduction of diſlocations, we ſhould examine the contiguous ſoft parts, to ſee whether they are in a fit ſtate for it or not; for although the ſooner the operation is attempted, the more certain will our ſucceſs in general be; yet whenever the ſurrounding teguments and muſcles are much contuſed and inflamed, it is better to allow the pain and ſwelling to ſubſide before we endeavour to reduce the bone; at leaſt I have always been in the practice of this. I never obſerved that any bad conſequences enſued from it; and I have known much miſchief done by a limb being ſtretched while the parts ſurrounding a diſlocated joint have been much ſwelled and inflamed.

In ſuch circumſtances, therefore, we ſhould endeavour, by local blood-letting with leeches, by the uſe of ſaturnine applications, a low regimen, and putting the limb in an eaſy relaxed poſture, to remove the inflammation before any attempt is made for reducing the bone.

In almoſt every diſlocation, one bone only is diſplaced: The other bone or bones of which the joint is formed remain in their natural ſituation; and it will be found perhaps univerſally, that it is the bone connected with the inferior part of a limb that is forced from its ſituation; the bone forming the upper part of the joint, if it be not fractured, being ſeldom in any reſpect altered: In the reduction therefore of luxations, the only attention to be given to the upper part of a limb, is to keep it firm and ſteady, while we endeavour by the eaſieſt and moſt effectual means to replace the inferior part of it.

A perſon not acquainted with anatomy, might be led to ſuppoſe that this may always be readily done; as he will be apt to conclude, that the ſame degree of force by which a bone is puſhed out of its place, will with equal eaſe replace it. This would no doubt be the caſe, were it the bone only upon which we had to act, or if the bone was connected with inorganic matter only that would not reſiſt the means employed to reduce it: But every joint being either partly ſurrounded by, or much connected with muſcles, the contractile power with which theſe are endowed, acts with much force and advantage againſt every attempt that can be made for the reduction of the bone; for they not only draw it beyond the end of the contiguous bone againſt which it ought to be placed, but they often pull it out of its natural direction, and fix it firmly in ſome neighbouring cavity, from whence it is diſlodged with difficulty; while the ſtimulus created by every trial that is made for replacing the bone, is apt to excite a further exertion of the muſcles, and to increaſe the difficulty of the reduction.

It is therefore obvious, that in the reduction of every diſlocated bone, the muſcles with which it is connected ſhould be put as much as poſſible into a ſtate of relaxation; for in this ſituation, the reſiſtance which they give to the force employed for moving the bone is inconſiderable, when compared with what is required for the ſame purpoſe, when they are kept in a ſtate of extenſion. In the one, it is uſually done with eaſe, both to the patient and ſurgeon; while in the other, that is, while a limb is much ſtretched or extended, it is with the utmoſt difficulty that a diſlocated bone can be moved.

By relaxing all the muſcles of a limb, we may in general obtain a ſufficient force for reducing a luxation merely by the hands of aſſiſtants; but in ſome inſtances more force is required than can be applied in this manner: In this caſe, various inſtruments have been propoſed for increaſing our powers of extenſion; ſome of which, and perhaps the moſt uſeful, are delineated in Plates LXXXVIII. LXXXIX. and XC.

But whether we find it neceſſary to uſe machines of this kind or not, no more force ſhould be ever employed than is juſt requiſite; and it ought always to be applied in a ſlow gradual way, by which there is much leſs riſk of any harm being done, than when the muſcles of a limb are forcibly and ſuddenly ſtretched: And it will alſo be underſtood, that the whole force uſed for the reduction of a diſlocated bone, ſhould be applied to that bone only, and not to any other part of the limb.

Beſides the reſiſtance ariſing from the action of the muſcles, we ſometimes meet with much difficulty from the projecting end of a diſlocated bone having paſſed that of a contiguous bone. In this caſe the extenſion is to be made in ſuch a direction as will beſt obviate this relative ſituation of the parts.

In extending a limb for the purpoſe of reducing diſlocations, the extenſion ſhould be carried ſo far as to diſlodge the diſplaced bone, and to bring the end of it on a line with the end of the other to which it is to be oppoſed, otherwiſe no advantage will be gained by the operation; for while any part of one bone projects paſt the extremity of the other, no means that we can employ will be able to replace it, unleſs ſuch a force is made uſe of, (as has ſometimes happened), as is ſufficient for breaking off the projecting part of the bone; while, on the contrary, the reduction is always accompliſhed in the eaſieſt manner, as ſoon as the diſplaced bone is drawn freely paſt all the projecting parts of the other: Nay, when the end of a diſplaced bone is brought to this ſituation, it would be difficult to prevent it from paſſing inſtantaneouſly into its natural ſituation; ſo that in the reduction of diſlocations, our chief object is to make a ſufficient degree of extenſion, when the ordinary action of the muſcles will for the moſt part replace the bone: Or when this fails, the moſt gentle preſſure will prove ſufficient.

The diſlocated bone being reduced, it ſeldom proves difficult to retain it in its ſituation, unleſs it has often been diſplaced before: The ſureſt means of retaining it, is to put the limb into a relaxed poſture, and to ſupport the bone that has been juſt replaced with a proper bandage, till the ſurrounding ſoft parts have recovered their natural tone.

The ſymptoms that prove moſt urgent in diſlocations, both before and after the bones have been reduced, are, pain, inflammation, and ſwelling. For the moſt part theſe ſymptoms abate ſoon after the reduction; but while any degree of inflammation continues, repeated applications of leeches ſhould be adviſed as the moſt effectual remedy: And as this ſymptom is to be conſidered as the cauſe of all the others, as well as of thoſe chronic pains to which joints are liable, that have ever been diſlocated, it therefore merits particular attention. But this ſubject having already been fully conſidered, when treating of contuſions, I muſt now refer to what was then ſaid upon it in Chapter II. Section II.

In the firſt part of this Section, I have ſaid that luxations are ſometimes combined with fractures of the diſplaced bones. When a bone is fractured at a conſiderable diſtance from the luxated joint, we may for the moſt part be able to reduce the luxation immediately; and this being done, the fracture ſhould be treated in the uſual way: But when a bone is fractured ſo near to the luxated joint that it cannot be laid hold of, the caſe is thereby rendered both difficult and uncertain. In the ſmaller joints, as in thoſe of the fingers and toes, the diſplaced portion of bone may in ſome inſtances be puſhed into its ſituation; but in all the larger joints, particularly in the hip-joint, and in that of the ſhoulder, we muſt firſt allow the fracture to heal, and the union of the fractured bones to be perfectly firm, before we can expect to reduce the luxation.

In compound luxations, that is, where joints are not only luxated but laid open by external injuries, the treatment that I have adviſed in compound fractures applies with equal propriety: Almoſt all the obſervations indeed that were made upon the one will apply with nearly equal force to the other: So that at preſent I ſhall refer to Section XV. of the laſt Chapter, where the ſubject was fully conſidered.

I may juſt ſhortly obſerve, that after the luxated bones are replaced, and the limb laid in a proper poſture, our next object is to prevent inflammation: This we do with moſt certainty by copious blood-letting, with leeches applied near to the injured parts; dreſſing the ſores with ſaturnine cerate, or any mild ointment; moderating the pain with adequate doſes of opiates; and a low regimen.

This being done, we have to endeavour to prevent the matter of the ſore from lodging about the joint, by placing the limb in ſuch a manner that it may moſt readily run off: If this fails, we ſometimes ſucceed by dreſſing the ſore more frequently, and abſorbing the matter with a bit of ſponge; or, when the quantity of matter is conſiderable, by a counter opening made in a more depending part of the limb.

When mortification takes place, it is to be treated in the manner I have adviſed in Chapter I. Section IV.

All that I have hitherto ſaid, relates in general to luxations produced by external violence. When they proceed from the heads of bones being puſhed from their ſockets, either by tumors of a fleſhy or oſſeous nature, or by collections of matter, they may almoſt in every inſtance be conſidered as incurable: When the joint is ſo ſituated that the diſeaſed parts can all be removed, this meaſure ſhould be adviſed; but when this cannot be completely accompliſhed, all that art ſhould attempt is, to give as free a diſcharge as poſſible to any matter that may form; and to ſupport the conſtitution with ſuch a diet, as may prevent it from being too much reduced by the diſcharge.

Diſlocations are ſometimes the conſequence of relaxation of the ligaments and tendons by which the bones in a healthy ſtate are kept together. This relaxation is ſeldom ſo completely removed as to prevent the bones from falling out from time to time; but the inconveniency may in ſome meaſure be obviated by ſupporting the limb with a bandage; by endeavouring to reſtore the tone of the relaxed parts by cold bathing; and, in ſome inſtances, electricity has appeared to prove uſeful.

We ſhall now proceed to ſpeak of diſlocations from external violence as they occur in particular parts.

SECTION II.

Of Luxations of the Bones of the Cranium.

THE bones of the cranium are frequently ſeparated from each other at the ſutures in hydrocephalus internus. This, however, can ſeldom become an object of ſurgery. If ſuch collections ſhall ever be removed by medicine, all that art can do further is to ſupport the parts with a bandage.

We alſo find that openings are in ſome inſtances produced at the ſutures by external violence, particularly by falls from heights. This, however, very commonly proves fatal. I have only met with one inſtance of a patient under ſuch circumſtances recovering. All that in this ſituation can with propriety be done, is to ſupport the parts by gentle preſſure with a proper bandage; to preſcribe blood-letting and other evacuations according to the violence of the ſymptoms; and to keep the patient quiet, and under proper confinement during the cure.

SECTION III.

Of Luxations of the Bones of the Noſe.

THE bones of the noſe are ſo firmly united, and ſerve ſo effectually to ſupport each other, that they are not often diſlocated.

Theſe bones being thinly covered with ſoft parts, luxations in any part of the noſe are eaſily diſcovered by the touch, as well as by the deformity which they produce.

In the reduction of luxations of theſe bones, the patient ſhould be ſeated oppoſite to a proper light, with an aſſiſtant behind ſupporting his head; and the ſurgeon ſtanding before, ſhould endeavour to replace the bones with as much accuracy as poſſible. In general, this may be done with the fingers alone; but when one of the bones is puſhed inwards, we do it more eaſily by puſhing one of the tubes in Plate XXX. fig. 2. up the correſponding noſtril, in order to elevate the depreſſed piece; and if the tube is guarded with ſome plies of ſoft lint, it may be retained in its ſituation till there is no longer any riſk of the bone ſlipping out.

When either of the bones of the noſe is puſhed outwards, it muſt firſt be exactly replaced, and afterwards retained in its ſituation by a proper application of a double-headed roller.

SECTION IV.

Of Luxations of the Lower Jaw.

THE lower jaw is connected by a very beautiful mechaniſm with the bones of the head. In each temporal bone there is an irregular oblong cavity, immediately before the external meatus auditorius. In theſe cavities, the two condyles of the lower jaw are lodged; and by means of two intermediate looſe cartilages which move along with the condyles, and which correſpond with the irregular ſurfaces of the cavities in which they are placed, ſuch a degree of firmneſs is given to this joint as would otherwiſe be inconſiſtent with the freedom of motion of which it is poſſeſſed; for although the condyles of the jaw are ſecured

cured in their ſituation, by different ligaments, as well as by ſtrong muſcles, particularly by the ſtrong tendons of the temporal muſcles inſerted into the coronoid proceſſes of the jaw; yet the variety of motions which the under jaw is conſtantly performing, would render it very liable to diſlocations, were it not for the intervention of theſe moveable cartilages; which admit of every neceſſary freedom, while ſuch a looſe, extenſive motion is prevented, as muſt have happened if the heads of the condyles had been placed in large ſmooth cavities without theſe cartilages between them.

The under jaw cannot be diſlocated either upwards, backwards, or laterally: It can only be diſlocated forward and downward. In every other direction, the condyles are ſo much ſurrounded with bone, that they cannot be forced out of their correſponding cavities, as will be readily ſeen on an examination of the ſkeleton: But when the mouth is widely opened, as happens in yawning, the condyles are apt to ſlip too far over the anterior boundaries of theſe cavities. In this manner a diſlocation takes place, as we diſcover by the chin being thrown forward and downward, while the mouth remains open, at the ſame time that much pain is produced by every attempt to cloſe it; nor can the patient ſpeak diſtinctly, or ſwallow but with much difficulty.

In ſome caſes, one ſide only of the jaw is diſlocated, that is, one of the condyles remains nearly in its natural ſituation, while the other is thrown entirely out. In this caſe, the jaw, inſtead of falling directly down, is puſhed obliquely downwards, and ſomewhat towards the ſide oppoſite to that in which it is diſlocated.

Beſides the ſymptoms that I have mentioned of pain on any attempt to cloſe the mouth, and difficulty in ſpeaking and ſwallowing, we are told by all the older writers on this ſubject, and by all who have copied from them, that luxations of the jaw are apt to induce convulſions, and even death. I have never, however, met with an inſtance of this, nor is it probable that it will ever happen, unleſs from great miſmanagement on the part of the ſurgeon.

A luxation of the jaw being very diſtreſsful, and even alarming to thoſe who are not acquainted with its nature, immediate aſſiſtance is commonly deſired; and with due attention we can ſeldom fail to reduce it.

The patient being firmly ſeated on a low chair, with his head properly ſupported behind, the ſurgeon ſtanding before, with his thumbs ſufficiently guarded, ſhould puſh them as far as they will go between the teeth of the upper and under jaws, the under or flat part of the thumbs being applied to the ſurface of the teeth of the under jaw: The palm of each hand ſhould be applied to the outſide, while with his fingers he lays a firm hold of the angles of each jaw. With the fingers applied in this manner, he ſhould pull the under jaw forward till he finds it move ſomewhat from its ſituation: And this being done, but not till then, he ſhould preſs the jaw forcibly down with his thumbs, and moderately backwards with the palms of his hands; when, if the different parts of the operation are rightly managed, the ends of the bone will immediately ſlip into their ſituation; upon which the thumbs ſhould be inſtantly withdrawn.

In general, we are directed to preſs the jaw downwards and backwards: But although this might ſucceed in ſome inſtances where the jaw is diſlocated only on one ſide, yet even there it would often fail; and it would ſeldom anſwer when both condyles are out: For, till the condyles are quite diſengaged from the bones on which they reſt, and which they can only be by pulling the jaw forward, all the force we could employ in pulling them down would be of little avail, as I have often had occaſion to obſerve.

I have deſired, in preſſing down the jaw, that at the ſame time it ſhould be preſſed moderately backwards. The ſlighteſt force, however, in this direction is ſufficient; nay, in ſome caſes it is not neceſſary; for, as ſoon as the condyles are ſufficiently depreſſed, they are almoſt inſtantaneouſly drawn into their natural ſituations by the ordinary action of the temporal muſcles, whether any force be applied for this purpoſe or not.

The treatment that I have adviſed anſwers equally well, whether the jaw be luxated on one ſide, or on both; but where one condyle only is thrown out, the force uſed for depreſſing the jaw ſhould be chiefly applied to that ſide.

The luxated jaw being reduced, the patient ſhould be adviſed to avoid every cauſe that might have any effect in throwing out the bone again; particularly much ſpeaking, gaping, and yawning, as the condyles are apt for a conſiderable time to be turned out by any of theſe actions.

In the reduction of a diſlocated jaw, the thumbs are very apt to be bit if they be not well protected, or if they be not inſtantly withdrawn on the bones ſlipping into their ſituation. For the moſt part, the end of a handkerchief is wrapped round them; but a covering of firm leather anſwers better, or a caſe of thin iron covered with leather, would be ſtill preferable, as it would not occupy ſo much ſpace. It would paſs farther into the mouth, and would thus act with more advantage in forcing down the jaw.

SECTION V.

Of Luxations of the Head.

THE head is connected in ſuch a manner with the atlas or firſt vertebra of the neck, that it moves upon it with eaſe and freedom backwards and forwards, the two condyles of the os occipitis being received into correſponding cavities in the ſuperior oblique proceſſes of that bone: But the lateral and rotatory motion of the head proceeds from the immediate connection between it and the ſecond vertebra of the neck, by means of the proceſſus dentatus of that bone; which paſſing through the back-part of the large cavity of the atlas, is fixed, by means of different ligaments, to the os occipitis.

The connection between the head and the firſt of theſe bones is ſo firm, that they are not perhaps ever ſeparated by accident; at leaſt, I have not heard of any inſtance of this being diſcovered on diſſection. It rather appears, that, in luxations of the head, the connection is deſtroyed between the head and the ſecond vertebra, the head being forced with ſuch violence forward as to ſtretch or rupture the ligaments by which the tooth-like proceſs of this bone is fixed to the occiput: At leaſt, this has been found to be the caſe in different inſtances of theſe diſlocations, and it alſo happens in thoſe who die by hanging.

In every diſlocation of the head, the head falls forward upon the breaſt; the patient is inſtantly deprived of ſenſibility; he lies as if he were dead; and he ſoon dies if the luxation be not quickly reduced. Injuries of this kind are produced moſt frequently by falls from great heights, or from horſeback.

Luxations of the head, for the moſt part, terminate fatally; but as inſtances have occurred where this has been prevented when timous aſſiſtance has been given, we have reaſon to think, that recoveries would be more frequent if this could be always procured.

Different means have been propoſed for the reduction of theſe luxations; but whatever requires much preparation is here inadmiſſible. In all ſuch caſes, our views muſt be inſtantly carried into effect; and it fortunately happens, that in perhaps every inſtance they may be accompliſhed without any preparation.

The patient being ſeated on the ground, and ſupported by an aſſiſtant, the ſurgeon ſtanding behind, ſhould raiſe the head from the breaſt; and the aſſiſtant being deſired to preſs down the ſhoulders, the head ſhould be gradually pulled ſtraight up till the diſlocation is reduced; or, if this does not happen with moderate extenſion, it may, at the ſame time, be gently moved from ſide to ſide. A ſudden noiſe or crack is heard on the reduction taking place; and if the patient be not entirely dead, an immediate and perhaps entire recovery of all his faculties enſues. In ſome caſes they have been completely reſtored on the head being replaced; but in others they have remained long impaired, and in ſome have always continued ſo.

The reduction being accompliſhed, the patient ſhould be immediately laid in bed. His head ſhould be kept elevated, and retained by a proper bandage for a conſiderable time in one poſture; and with a view to prevent inflammation, blood-letting ſhould be preſcribed in ſuch quantities as his ſtrength will bear; his bowels ſhould be opened with proper laxatives; and he ſhould be confined to a low regimen.

SECTION VI.

Of Luxations of the Spine, Os Sacrum, and Os Coccyx.

THE vertebræ, or bones of which the ſpine is compoſed, are ſo intimately connected, by the proceſs of one bone running into correſponding parts of another, as well as by ſtrong ligaments and muſcles, that they are ſeldom diſlocated. They are ſo firmly united indeed, that I do not ſuppoſe that any of them can be diſlocated by external violence without being fractured. Beſides the means of connection that I have mentioned, the vertebræ of the back are much ſtrengthened by the ſupport which they receive from the ribs.

I never met with a complete diſlocation of any of the vertebræ; nor do I ſuppoſe that it ever happens, even when accompanied with a fracture, but with immediate death: For the force neceſſary to move one of the vertebræ from its ſituation, muſt not only be attended with the compreſſion, but even with the laceration of the ſpinal marrow, while the contents of the thorax or abdomen muſt in a very eſſential manner be hurt by it. I do not ſuppoſe, therefore, that a complete diſlocation of any of theſe bones can ever become an object of ſurgery.

We know, however, that one or more of the vertebræ may be partially diſlocated, and that the patient may ſurvive. In ſome caſes, perhaps, a complete cure may be obtained; but I believe that it does not frequently happen.

Theſe luxations are uſually produced by falls from great heights; by violent blows; or by heavy weights paſſing over the body.

They are diſtinguiſhed, by the body being diſtorted, by examination with the fingers, and by the ſymptoms which they induce; which are ſuch as uſually occur from compreſſion of the ſpinal marrow; particularly a paralyſis of all that part of the body lying beneath the injured part, and either a total ſuppreſſion of urine, or an involuntary paſſing of both urine and fæces.

There is reaſon to ſuppoſe, from the mechaniſm of the parts, that the vertebræ will ſeldom or never be diſlocated outwards: They are uſually forced directly forward, or in ſome degree to the right or left. On this account they are extremely difficult to reduce, as the contents of the thorax or abdomen muſt always lie between the injured parts and the means that are uſed for this purpoſe.

Various means have been propoſed, and different machines invented, for the reduction of diſlocated vertebræ. Theſe machines, however, ſhould be laid aſide, as being not only uſeleſs, but dangerous; for whoever has paid attention to the anatomy of the ſpine, will ſee, that in diſlocations of the vertebræ, ſcarcely any advantage is to be gained from the application of much force, while much miſchief may evidently enſue from it.

When one or more of the vertebræ are luxated forward, of which we can only judge by an accurate examination with the fingers, the moſt certain method, perhaps, of reducing the diſplaced bones is, to bend the body ſlowly and gradually forward, as far as it can be done, over a caſk, or any other cylindrical ſubſtance of a ſufficient ſize. If the bone by this poſition regains its ſituation, the body ſhould be immediately raiſed; while the attempt may be repeated when it does not ſucceed at firſt.

When the diſplaced bone is puſhed much out of its natural ſituation, neither this nor any other method will probably ſucceed; but it has certainly done ſo in different inſtances of partial diſlocations. In bending the body forward, the two vertebræ lying contiguous to the one that is puſhed forward are ſomewhat farther ſeparated from each other; by which, the diſplaced bone may, either by the compreſſion produced upon the abdomen, or by the ordinary action of the contiguous muſcles, be forced into the ſituation that it formerly occupied.

When the diſlocated bone, inſtead of being puſhed ſtraight forward, is forced in any degree to one ſide, the body while the reduction is attempting, ſhould not only be bent forward, but ſomewhat towards the affected ſide; by which, the two contiguous vertebræ will be ſeparated to a greater diſtance than they poſſibly could be by bending it either directly forward or towards the oppoſite ſide.

When any part of the os ſacrum is luxated, all that can be done is to replace it with as much exactneſs as poſſible by external preſſure, and by bending the body forward in the manner I have mentioned.

The coccyx is more frequently luxated than any of theſe bones, as it is equally ly liable to the ſame kinds of injuries, beſides being more expoſed to the effects of falls, and to be injured in delivery.

This bone may be luxated either outwardly or inwardly. It is apt to be forced outwards in laborious births when much violence is uſed in pulling down the head of a child; and it has alſo been diſplaced by large collections of hard fæces in the rectum. We judge of this having happened, from the pain which takes place all over the region of the loins, particularly about the junction of the os coccyx with the ſacrum; and from the diſplaced bone being diſcovered upon examination with the fingers.

When the coccyx is luxated inwardly either by falls or blows, the patient complains of much pain, and of the ſenſation of a tumor or ſome other hard body compreſſing the under part of the rectum; he is liable to teneſmus; he finds it difficult to paſs his fæces; and in ſome inſtances, a ſuppreſſion of urine takes place. On the finger being introduced at the anus, the diſplaced portion of bone is readily diſcovered.

In outward luxations of the coccyx, we ſeldom find it difficult to replace the bone by external preſſure with the fingers; but it is often difficult to retain it in its ſituation. It can only be done by ſupporting the parts with proper compreſſes and bandages, for which purpoſe the T bandage anſwers better than any other.

In the reduction of an internal diſlocation of this bone, the fore-finger of one hand, after being immerſed in oil, ſhould be paſſed as far as poſſible up the rectum. By means of it the bone ſhould be preſſed into its ſituation; while with the other hand we ſupport the parts outwardly that correſpond with it.

As diſlocations of theſe bones, particularly of the coccyx, are very apt to excite inflammation, and as this often terminates in abſceſſes that do not readily heal, we ſhould omit nothing that may probably tend to prevent it. Blood-letting ſhould be preſcribed in proportion to the ſtrength of the patient, particularly local blood-letting with leeches, or cupping and ſcarifying; a lax ſtate of the bowels ſhould be preſerved; and the patient ſhould be confined to that poſture in which he is eaſieſt, and to a low regimen.

SECTION VII.

Of Luxations of the Clavicles.

THE clavicles are joined to the ſcapula at the acromion, where they give conſiderable ſupport to the joint of the ſhoulder; and their interior ends are ſupported by the upper part of the ſternum.

As the clavicles are not poſſeſſed of much ſtrength, and being tied at their articulations to the contiguous bones by ligaments, they are more expoſed to fractures than to luxations. In ſome caſes, however, they are luxated. This may happen at either extremity of theſe bones, but it is more frequent at their junction with the ſternum than at the acromion; for the force by which luxations of the clavicles are produced, is for the moſt part applied to the ſhoulders, by which their oppoſite ends are moſt apt to be puſhed out.

As the clavicles are thinly covered, luxations of either of their extremities are eaſily diſcovered: They commonly produce a good deal of ſtiffneſs and immobility in the correſponding joint of the ſhoulder; for the neck of the ſcapula having loſt its ſupport, it is apt to be drawn out of its ſituation; by which the motion of every muſcle connected with the joint is neceſſarily affected.

A diſlocation of the clavicle is eaſily reduced by moderate preſſure with the fingers, eſpecially if the arms and ſhoulders are at the ſame time drawn back; by which the ſpace which the clavicle ſhould occupy may be ſomewhat lengthened. It is more difficult, however, to retain the bone in its ſituation, as it is apt to be again diſplaced on the preſſure being removed, by the ordinary action of the flexor muſcles of the arm.

We derive little advantage here from ſupporting the arm. On the contrary, when the end of the clavicle connected with the ſternum is diſplaced, raiſing the arm does harm, as it tends to puſh the bone farther out of its place. It is, therefore, highly neceſſary to attend to this difference between the management of fractures and luxations of this bone. In the latter, an elevated poſture of the arm does miſchief: In the former, it proves uſeful, as I have ſhewn in Chapter XXXIX., Section V.

The weight of the fore-arm ought however to be moderately ſupported to prevent the ſhoulder from being too much drawn down. Beſides this, the head and ſhoulders ſhould be ſupported, and a moderate preſſure made upon the diſplaced end of the bone. Various bandages have been propoſed for this, particularly the long roller applied in ſuch a manner as to form the figure of 8 upon the ſhoulders and upper part of the breaſt. No advantage, however, is gained from this, as the bandage cannot be retained ſo firmly in its ſituation as to have any effect without impeding reſpiration. The machine repreſented in Plate XCIV. fig. 1. nearly the ſame as is commonly uſed for ſupporting the head, anſwers the purpoſe better than any other: For while it neceſſarily raiſes the head and keeps the ſhoulders back, the ſtraps that paſs over the upper part of the breaſt may be made to act with ſome force upon the diſlocated end of the bone. It is ſcarcely neceſſary to obſerve, that the uſe of this machine ſhould be continued for a conſiderable time, otherwiſe the bone is apt to ſtart, when the whole is to do over again.

SECTION VIII.

Of Luxations of the Ribs.

BY many it has been ſuppoſed that the ribs cannot be diſlocated; and accordingly this variety of luxation has paſſed unnoticed by different writers on this branch of ſurgery. It is only at the articulation of the ribs with the vertebræ that luxations can happen; and being connected with theſe bones by ſtrong ligaments, they more frequently break than yield at the joints.

It will readily, however, appear, by accurate examination of the junction of the ribs with the vertebræ, that they may be diſlocated inwards. They cannot indeed be puſhed either upwards, downwards, or backwards; but we know from experience, that a ſtrong force applied near to their articulations, will rupture their connecting ligaments, and thus puſh them forward; for the fact has been proved by diſſection after death.

The ſymptoms induced by diſlocations will be nearly the ſame with thoſe that enſue from fractures of the ribs, namely, pain in the injured part, with difficult reſpiration; and if the end of the bone is puſhed into the ſubſtance of the lungs, emphyſematous ſwellings may enſue from it. A diſlocation, however, may be diſtinguiſhed from a fracture, by the pain being moſt ſevere at the articulation, and by no part of the bone yielding to preſſure excepting at this very ſpot.

I believe it will commonly happen, that the end of a luxated rib, in conſequence of its elaſticity, will return to its natural ſituation when the cauſe by which the luxation was produced is removed; but when it does not, the beſt method of reducing it will be to bend the body forward over a caſk or other cylindrical body, while the vertebræ immediately above and below the rib are preſſed inward with as much force as can with ſafety be applied to them. After this, a thick compreſs of linen ſhould be laid over theſe vertebræ, and another long one along the moſt prominent part of the diſlocated rib and the two ribs immediately contiguous; when, by means of a long broad roller paſſed two or three times round the body, ſo much preſſure may be made upon the vertebræ as will retain them in their ſituation; while the preſſure made upon the projecting part of the rib tends to keep the end of it in its ſituation till the ligaments that were ruptured are again united.

No bandage ſhould be applied with ſuch tightneſs as to impede the breathing. The beſt method of preventing the roller from moving, is by the ſcapulary bandage paſſed over the ſhoulder, and a ſtrap connected with it behind, carried behind the thighs and fixed to it before.

No diſlocation is more apt to induce inflammation of the contiguous parts, and other diſagreeable ſymptoms; for the prevention and removal of which, nothing anſwers ſo well as copious blood-letting, preſerving the patient cool, and at perfect reſt, a low diet, gentle laxatives, and opiates if a cough enſues and becomes troubleſome.

SECTION IX.

Of Diſlocations of the Humerus at the Joint of the Shoulder.

THE joint of the ſhoulder is formed by what is uſually termed a Ball and Socket, the round head of the os humeri being lodged in a cavity on the anterior part of the ſcapula. This cavity, however, is ſo ſuperficial, that in the ſkeleton it does not appear to contain above a tenth part of the head of the humerus; but in the recent ſubject it is much more conſiderable, by means of a cartilaginous brim; and a capſular ligament ſurrounds the whole joint. By this mechaniſm, the ſhoulder enjoys more free motion than other joints; but by this it is alſo expoſed to more frequent luxations; inſomuch, that we meet with more diſlocations of the ſhoulder than of all the other joints of the body.

The os humeri is moſt frequently luxated downwards directly into the axilla, owing to the head of the bone meeting with leſs reſiſtance in falling into this ſituation than in any other direction. The head of the bone is ſometimes puſhed downwards and forward, and lodged beneath the pectoral muſcle, when we find it reſting on the ribs between the coracoid proceſs of the ſcapula and the middle of the correſponding clavicle. In a few caſes it is diſlocated downwards and backwards: But it can never be luxated upwards without being accompanied with a fracture of the acromion; of the coracoid proceſs; or perhaps of both.

The head of the bone, as I have already obſerved, takes for the moſt part that direction in which it meets with the leaſt reſiſtance; but this alſo depends in ſome degree on other cauſes, particularly on the part of the joint which received the injury, and on the ſituation of the humerus

merus at the time. Thus, if a blow falls upon the upper part of the joint, while the arm is in a direct line with the body, any diſlocation that takes place will be downwards; while the head of the bone will moſt probably be forced downward and inward by any ſtroke given to the outſide of the joint while the elbow is ſtretched back, and vice verſâ.

We judge that the humerus is diſplaced by the patient being unable to move the arm; by pain being excited on every attempt to preſs the arm near to the ſide; by the arm being of a different length from the other; from its being longer or ſhorter according as the head of the bone is lower or higher than its natural ſituation in the acetabulum ſcapulæ; by the head of the bone being felt either in the arm-pit, beneath the pectoral muſcle, or backwards below the ridge of the ſcapula; and by a vacancy being diſcovered beneath the acromion. If the two ſhoulders are examined together, which ſhould always be done, the ſound joint will be found round and prominent, while the fore-part of the other, if much tumefaction has not taken place, will appear to be flat, or even ſomewhat hollow. This difference in appearance between the two joints appears moſt obviouſly on viewing them both from above downwards.

In luxations of long duration, the whole arm is apt to become œdematous, and to be in ſome degree deprived of ſenſibility, from the preſſure produced upon the nerves and lymphatic veſſels of the arm by the head of the bone. All the other appearances I have mentioned, are likewiſe ſo obviouſly induced by the diſplacement of the head of the humerus, that ſcarcely any of them require to be explained. The head of the bone being thrown out of its natural ſituation, muſt neceſſarily affect the action of every muſcle of the joint: Some will be too much relaxed, while others are over-ſtretched: The motion of the joint muſt of courſe be conſiderably impaired. It is obvious too, that much pain muſt be excited by the arm being preſſed down to the ſide, as the head of the bone will not only be forcibly rubbed againſt ſome part of the ſcapula, but the ſoft parts on which it reſts muſt be greatly compreſſed, at the ſame time that ſome of the contiguous muſcles will be ſtretched to a degree which they cannot eaſily bear.

In a ſimple diſlocation of the humerus, our prognoſis ſhould in general be favourable; for in recent caſes we ſeldom fail in the reduction of the bone. Inſtances not unfrequently however occur, in which the operation is difficult; but this is ſeldom the caſe where it has been properly conducted from the firſt. In diſlocations, indeed, of long continuance, the moſt expert practitioners often fail; for in ſuch caſes, the head of the bone has often formed a ſocket among the contiguous parts, from whence it cannot be diſlodged without tearing aſunder ſome of the muſcles with which it is ſurrounded; and when diſlodged, our endeavours may be rendered abortive, by the cavity in which the bone ſhould be lodged being diminiſhed. In all caſes, therefore, of long duration, that is, where the bone has been out of its place for ſix months or upwards; for I have often ſucceeded where it has been out two, three, and even four months; although it may be proper to make ſome attempts to replace the diſlocated bones, yet none that require great force ſhould be much perſiſted in, for the attempt muſt always be of uncertain ſucceſs, while it neceſſarily gives a great deal of pain, at the ſame time that it is apt to render the motion of the head of the bone in the artificial ſocket, which it generally forms for itſelf, more ſtiff than it was before.

In general it is ſuppoſed, that the humerus is more eaſily reduced when the head of the bone is lodged in the axilla than when it is puſhed forward beneath the pectoral muſcle; but more eaſily when lodged beneath this muſcle than where it is forced back beneath the ſpine of the ſcapula. The latter I believe to be ſo; but I have not found in the treatment of the others that there is any difference between them.

In the reduction of a diſlocated humerus, we are in general told, that it is to be done by extenſion, counter extenſion, and the ſubſequent application of ſuch a force as is ſufficient to replace the bone. Theſe three indications, however, may all be comprehended in one. If a ſufficient degree of extenſion is applied for drawing the head of the bone on a line with the acetabulum, the ſurgeon will ſeldom have any thing farther to do; for when brought to this ſituation, the reduction is almoſt in every inſtance inſtantly completed by the ordinary action of the muſcles.

All that we have to do by counter extenſion, is to fix the body ſteadily while the arm is extending, and to prevent the ſcapula from being drawn forward by the force that is neceſſary for moving the arm; for if this bone be not fixed, it in ſome degree moves forward with the humerus, by which the force employed for extending the arm is in ſome meaſure loſt, at the ſame time that the cavity in the ſcapula in which the head of the bone is to be placed, is thus kept in a ſtate of motion, by which the reduction cannot be ſo readily effected.

This being done, our powers of extenſion are applied to the arm, till the head of the bone is drawn on a line with the brim of the ſocket; when, as I have obſerved above, it will inſtantaneouſly ſlip into its place by the action of the contiguous muſcles; ſo that there is no neceſſity for the application of any force for this purpoſe. Much miſchief has often been done by force applied with this view, as we ſhall preſently ſee on conſidering the different modes of reducing luxations of this joint; for it is obvious, if the force that is uſed for raiſing the humerus is applied before the end of it is drawn paſt the moſt projecting point of the ſcapula, that the two bones muſt be thus preſſed together ſo as to obſtruct the reduction.

Various modes have been propoſed for the reduction of diſlocated ſhoulders, inſomuch that we ſeldom meet with two practitioners who do it in the ſame manner: But as one or other of theſe muſt be preferable to the reſt, and as it is of much importance to have this aſcertained, I ſhall offer a few obſervations upon each of them, and ſhall more particularly deſcribe that which to me appears to be the beſt.

1. The humerus is often reduced by preſſure with the heel upon the head of the diſplaced bone. The patient being placed upon the floor, the ſurgeon alſo ſitting upon the floor directly before him, puts the heel of one foot, that of the left foot when he is operating upon the left ſhoulder, and vice versâ, upon the head of the bone; and laying hold of the fore-arm with both hands, he extends the arm, at the ſame time that he endeavours with his heel to puſh up the bone.

When the head of the bone has fallen directly downward into the arm-pit, we are directed by ſome to place a ſmall tennis ball or any other round ſubſtance between it and the heel; by which the preſſure may be continued with more certainty into the bottom of the axilla than where the heel alone is employed.

This method, however, is liable to three very important objections. By laying hold of the fore-arm, the joint of the elbow is conſiderably ſtretched, by which it may be much hurt, while a great part of the force is ſpent upon it which ought to have been applied entirely to the os humeri: By extending the fore-arm, ſeveral of the muſcles of the arm itſelf, as well as the biceps flexor cubiti, are put upon the ſtretch; by which the extenſion is rendered much more difficult than when theſe muſcles are relaxed by the joint of the elbow being properly bent. And, laſtly, whether the heel be employed by itſelf or with a ball, it is much more apt to do harm than good; for if it be not applied with ſuch nicety and exactneſs, as to puſh the head of the bone directly towards the ſocket, it muſt neceſſarily force it againſt the neck of the ſcapula or ſome of the contiguous parts, and will thus tend in the moſt effectual manner to counteract the extenſion of the arm.

Beſides, in this manner, the arm muſt in every inſtance be pulled in a very oblique direction downwards by the relative ſituation of the ſurgeon and patient; whereas it ſhould in ſome caſes be raiſed nearly, though not entirely, to a right angle with the body, and kept in that poſition while the extenſion is going on.

It may be alleged, indeed, that this method often ſucceeds, and that it has long been employed by ſome of our oldeſt and moſt experienced ſurgeons. This I admit: But I alſo know that it often fails, even with thoſe who ſpeak moſt favourably of it; and that other modes of treatment have in various inſtances anſwered, where this had previouſly failed.

2. Others attempt to reduce this diſlocation, by endeavouring to force the head of the bone into the ſocket with a rolling-

pin applied beneath it, while a ſufficient force is employed for extending the arm, and for fixing the body in its ſituation. With a view to prevent the pin from hurting the ſkin, we are deſired to cover it with flannel, and that part of it which paſſes into the axilla is directed to be more thickly covered than the reſt.

But however this may in ſome inſtances ſucceed, it ought by no means to be received into practice. It is evidently liable to moſt of the objections I have mentioned to the mode of operating with the heel; particularly to the riſk of forcing the head of the humerus in beneath the neck of the ſcapula, and thus counteracting the force employed for extending the arm. It is obvious, too, even on the principle upon which it is recommended by thoſe who practiſe it, that this, as well as the mode of operating with the heel, cannot be applicable where the head of the bone is lodged either backward, or forward beneath the pectoral muſcle: For the ſole intention of both is to raiſe the head of the bone; and yet by ſome they are uſed indiſcriminately, whether the bone is luxated downwards, backwards, or forward.

3. The patient being properly placed, the body fixed by aſſiſtants, and the arm extended in the manner I ſhall afterwards direct, ſome ſurgeons make uſe of a towel or girth for pulling the head of the bone into the ſocket. The ends of the girth being tied together, one end of the double is put over the arm, and carried near to the head of the humerus; and the other being paſſed over the neck of the operator, he forces up the end of the bone by raiſing his neck; and if this could be done with ſufficient exactneſs, juſt when the head of the humerus has cleared the brim of the ſocket, no harm would ariſe from this part of the operation; but if the force for elevating the bone be applied before a ſufficient degree of extenſion is made for this purpoſe, it muſt evidently do miſchief, by locking the head of the humerus and neck of the ſcapula together: So that this is in ſome

meaſure liable to the ſame objections that I have ſtated to the mode of operating with the heel and rolling-pin.

Theſe were the means uſually employed for reducing luxations of this joint; but being frequently found to fail, others have at different times been propoſed in order to increaſe the powers of extenſion.

4. Of this nature is the Ambe of Hippocrates, as it is uſually termed: It is the one that was chiefly employed by ancient practitioners, and in ſome parts of Europe it is ſtill the only inſtrument uſed for this purpoſe: For this reaſon I have given a delineation of it in Plate LXXXVIII. fig. 1., but I do not by any means adviſe it to be employed. The powers of which it is poſſeſſed are great, but they cannot be properly applied; ſo that they are pernicious in proportion to their extent. It is liable in a tenfold degree to the objection I have ſtated above to the three preceding modes of reducing this bone, that of preſſing the head of it againſt the neck of the ſcapula; by which one or

other of them muſt frequently be broken, as will readily occur to whoever examines this inſtrument with attention; for inſtead of extending the arm before raiſing the end of it, the firſt action of this inſtrument is to raiſe the extremity of the bone, by which it muſt be ſo firmly puſhed in beneath the neck of the ſcapula, as to counteract with much effect the power afterwards applied to extend it.

5. The method of reducing this joint by means of a ladder has been long known, but I hope not often employed. The diſlocated arm being hung over the upper ſtep of the ladder, to which height the patient muſt be previouſly raiſed, and being ſecured in this ſituation by aſſiſtants, the ſeat on which he is placed is ſuddenly drawn away; by which the whole weight of the body falls upon the luxated joint and by which we are told the bone may often be reduced when other means have failed. The top of a high door is ſometimes uſed for the ſame purpoſe. Whether the door or ladder is

employed, that part upon which the arm is made to reſt ſhould be well covered with ſeveral plies of ſoft cloth or flannel.

6. The patient being laid upon the floor, the bone has in ſome inſtances been reduced by two or three ſtout men ſtanding upon a table, and lifting him ſuddenly up by the luxated arm.

7. Upon the ſame principle, it has been propoſed to raiſe the patient by the luxated arm with ropes running over pullies fixed in the ceiling of a high-roofed apartment. The jerk produced by the body being ſuddenly raiſed and let down, has in ſome caſes ſucceeded where other attempts to reduce the humerus had failed.

This was firſt practiſed, I believe, by the ingenious Mr White of Mancheſter; and I have known it ſucceed in different caſes of old luxations: But theſe methods are all liable to great objections. The force is too ſuddenly applied; by which more miſchief may be done to the ſurrounding ſoft parts than can be compenſated by the reduction of the bone. We know that muſcles, bloodveſſels, and ligaments, will ſtretch to a conſiderable degree, if the extending force be applied in a gradual manner: But we alſo know, that they very readily break when powerfully and ſuddenly ſtretched. Of this we have a remarkable inſtance in the burſting of the capſular ligaments of joints, which I believe to happen, as I have endeavoured to ſhew, in almoſt every caſe of luxation from external violence. This leads us to ſay, that any force that is uſed for the reduction of luxations ſhould be applied in the moſt gradual manner, and that the mode of operating we are now conſidering, muſt frequently do harm by tearing and lacerating the ſoft parts ſurrounding the joint. Of this I have had various inſtances even where the teguments have been protected in the moſt cautious manner, by covering them with ſoft flannel, and afterwards with firm leather, before applying the ropes for extending the arm.

Beſides, in theſe modes of reduction, the arm muſt be always extended in the ſame direction, whether the bone be luxated forward, downward, or backward: Whereas the direction in which the arm is extended, ſhould vary according to theſe circumſtances; as muſt be obvious to whoever attends to the anatomy of the parts concerned in the luxation. Nay in one variety of luxation, irreparable miſchief may be done to the joint, by extending the arm in a direction which, in another, might not only be proper, but neceſſary. Where the head of the humerus is puſhed forward beneath the pectoral muſcle, or directly backward, we may readily ſuppoſe that it may be eaſily reduced by pulling the arm upward, as is done when the body is ſuſpended by a pully in the manner I have mentioned; while much harm may be done by it, where the head of the bone is lodged in the axilla, and puſhed beneath the neck of the ſcapula. In this caſe, the end of the humerus is often ſo firmly wedged between the ſcapula and ribs, that one or other of theſe bones would neceſſarily break by the ſudden application of much force in this direction; and it can only be prevented by extending the arm ſomewhat obliquely downward till the head of the humerus is quite diſengaged.

8. A machine has been invented for conjoining the power of the ambe, with the mode of operating we have juſt been conſidering; in which the patient's body is nearly ſuſpended by the diſlocated arm, and is ſuddenly raiſed and let down again while the operator endeavours with the lever of the ambe to elevate the head of the bone. The invention is ingenious, and the inſtrument is evidently powerful; but if our objections to theſe two modes of operating, taken ſeparately, are well founded, they are no leſs ſo when they are combined. The powerful action of the lever muſt be hazardous in proportion to the uncertainty of its application. While the body is quickly riſing and falling, the lever cannot poſſibly be applied with exactneſs to the end of the bone; and if made to act with much force before the head of

the humerus is cleared of the ſcapula, one or other of theſe muſt neceſſarily give way.

9. When the more ſimple methods of reducing luxations have failed, ropes and pullies have ſometimes been employed. Of theſe, different forms may be ſeen in Plate LXXXIX. fig. 2.; in Scultetus, Plate XXII. fig. 1.; and in Plate X. fig. 7. of Deſagulier's Experimental Philoſophy. With one or other of theſe, any degree of force may be applied that can ever be required for this purpoſe.

10. But when recent caſes are properly managed, luxations may in almoſt every inſtance be reduced without any aſſiſtance from machinery. I often ſucceed by the moderate extenſion I am able to make of the arm with one hand, while the other is employed in preſſing back the ſcapula. This, however, requires all the muſcles of the arm and fore-arm to be as much relaxed as poſſible; which we accompliſh by bending the elbow moderately, raiſing the arm to a height ſomewhat leſs than a right angle with the body,

dy, and preſerving it in ſuch a direction as to prevent either the pectoral or extenſor muſcles of the arm from being ſtretched. When the arm is in this ſituation, we often find luxations eaſily reduced which had previouſly reſiſted the greateſt force; for in this manner we not only relax the muſcles of the arm, but the capſular ligament of the joint; by which the head of the bone returns more readily by the opening at which it was forced out than it otherwiſe poſſibly could do. For when the ligament is much ſtretched, it will graſp the neck of the bone, by which our being able to return it will neceſſarily be rendered more uncertain.

More force, however, is ſometimes required than can be applied in this manner; and the following is a method by which I have never yet failed in recent luxations. The patient is ſeated upon a chair, and his body ſecured by a long broad belt paſſed round it, and given to aſſiſtants, or tied round a poſt: A firm band of leather, four or five inches broad, and lined with flannel, as is repreſented in Plate LXXXIX., fig. 3., is now tied round the arm immediately above the elbow. The three ſtraps or cords connected with this band being given to aſſiſtants, they are deſired to extend the arm in the relaxed poſition I have mentioned, and in a ſlow equal manner, while another aſſiſtant ſtanding behind is employed in keeping the ſcapula firm. The ſurgeon himſelf ſtands moſt conveniently on the outſide of the arm: His buſineſs is to direct the aſſiſtants in the degree of force they are to employ, and to point out the direction in which the arm is to be extended; he may alſo ſupport the fore-arm and retain it bent at the elbow, in the manner I have mentioned. As ſoon as the head of the bone is drawn clearly paſt the brim of the ſocket, the extenſion of the arm ſhould be ſomewhat relaxed, when the reduction will for the moſt part be accompliſhed by the action of the muſcles of the joint; or it will be readily ly effected by moving the arm gently in different directions. A crack is heard on the bone ſlipping in; the patient finds immediate relief; and the anterior part of the ſhoulder acquires its uſual prominent form.

The direction in which the arm is extended, muſt depend upon the ſituation of the head of the bone: That in which it will meet with the leaſt reſiſtance is always to be preferred. When the head of the bone is puſhed forward, and lodged beneath the pectoral muſcle, the arm ſhould be raiſed to a right angle with the body, and the ſame direction will anſwer where it is puſhed backward; but in the moſt frequent kind of luxation of this joint, where the head of the bone is lodged in the arm-pit, the arm ſhould uniformly be drawn ſomewhat obliquely downward: If extended when raiſed to a right angle with the body, it would be drawn againſt the neck of the ſcapula, by which much pain would be excited, and the reduction fruſtrated. Of this I have ſeen many inſtances, as every practitioner muſt have done.

It ſhould be a general rule in the treatment of every luxation, to vary the direction in which the extenſion is made as ſoon as any conſiderable reſiſtance is met with; but in luxations of the humerus, attention to the obſervations I have juſt thrown out will for the moſt part prove ſufficient.

In reducing luxations of this joint, it has been the prevailing practice to preſs the ſcapula forward and downward: Nearly the reverſe of this, however, ſhould be adopted. By preſſing the ſcapula downward, we force it againſt the head of the humerus, the very thing we ought moſt carefully to avoid: And by forcing it forward, it is evident that the end of the humerus will not be ſo eaſily drawn out from beneath it, as when the aſſiſtant is deſired to pull it backward in the manner I have mentioned.

11. The mode of treatment I have juſt been deſcribing, will ſucceed in almoſt every inſtance of recent luxation; and it

will ſeldom fail even in caſes of long ſtanding, where the reduction of the diſlocated bone is practicable: But when a greater force is required than can be applied in this manner, the inſtrument repreſented in Plate XC. may be employed. It was invented by the late Mr Freke of London; and it anſwers the purpoſe of extenſion better, and with more exactneſs, than any that I have ſeen. It is delineated exactly from the plate given of it by Mr Freke; but it admits of ſome improvements. The ſtrap A A which paſſes over the ſhoulder, preſſes down the ſcapula, and thus impedes the reduction of the bone: It ſhould therefore be either entirely wanting, or made with a ſlit to paſs over the arm ſo as to draw the ſcapula back: In which caſe, inſtead of paſſing obliquely downwards to be fixed in the floor, it ſhould paſs ſtraight acroſs, and be fixed in a poſt on a line with the ſhoulder.

I have already obſerved, that the uſe of a lever in raiſing a luxated humerus is both unneceſſary and dangerous: The lever of this inſtrument, therefore, inſtead of being moveable, ſhould be fixed ſo as only to ſerve as a ſupport to the arm; or if it ever is uſed as a lever, it ſhould be managed with the utmoſt caution. The principal advantage that we derive from this inſtrument, is our being able, by means of it, to apply any force that may be neceſſary in the moſt gradual manner; an object of the firſt importance in the reduction of luxations: It alſo extends the arm in any direction we may judge proper; by which it can at once be adapted to any variety of luxation.

Swelling, pain, and inflammation, when they occur as conſequences of luxations of the arm, are to be removed by the remedies uſually employed in ſuch caſes, but chiefly by local blood-letting with leeches.

The round head of the biceps flexor cubiti, which paſſes through the joint of the ſhoulder, and is lodged in a groove in the head of the humerus, is apt to be ſeparated from this bone when it is forced far out of its natural ſituation, and thus induces a ſtiff unwieldy ſtate of the arm: For the moſt part it returns immediately to this groove on the diſlocation being reduced; ſo that there is commonly cauſe to ſuſpect that it continues to be diſplaced when any unuſual pain, ſtiffneſs, or tenſion remain. The moſt certain method of replacing it is to move the arm from time to time in every variety of way; and we know that it is replaced, by an inſtantaneous removal of the diſtreſs.

The glenoid cavity of the ſcapula being very ſuperficial, the head of the humerus is apt to fall out again, even after it has been completely replaced; particularly when it has been frequently luxated. The moſt certain method of preventing this is to ſupport the arm in a ſling, as is repreſented in Plate XCIX. fig. 2., till the parts recover their tone. Bliſters applied to the ſhoulder, and pumping cold water over the joint, have alſo proved uſeful for this purpoſe.

SECTION X.

Of Luxations of the Fore-arm at the Joint of the Elbow.

THE bones of the fore-arm at the elbow are more frequently diſlocated upward and backward than in any other direction: They can ſcarcely be luxated laterally or forward, if the injury be not at the ſame time accompanied with a fracture of the olecranon or top of the ulna, as will be readily perceived on examining the connection of that proceſs with the cavity in the poſterior part of the os humeri.

As the joint of the elbow is not deeply covered with ſoft parts, luxations of the bones are eaſily diſcovered as long as ſwelling and tenſion have not taken place. When theſe ſymptoms occur to any extent, it is often difficult to diſtinguiſh either the nature or extent of the injury with which they are connected. When the luxation is backward, the olecranon is felt on the back part of the arm, and the condyles of the humerus are puſhed forward. When the olecranon is broken off, and the ulna and radius puſhed forward, they are alſo apt to be drawn upward on the anterior part of the humerus, when the condyles of that bone are diſcovered behind. The extent of the joint is ſo conſiderable from one ſide to the other, that the bones compoſing it can never be completely luxated laterally, unleſs the ſoft parts with which they are covered are much lacerated. In whatever way they are diſplaced, the joint becomes immediately ſtiff and immoveable.

In the reduction of theſe diſlocations, the patient ſhould be ſeated on a chair of a convenient height, and the arm firmly ſecured by an aſſiſtant: When the bones are luxated backward, the fore-arm ſhould be moderately bent, in order to relax the flexor muſcles: While in this poſition it ſhould be ſlowly and gradually extended; and if care be taken to increaſe the curvature of the elbow in proportion as the extenſion is made, we ſeldom or never fail to complete the reduction. Where the olecranon is broken off, and the ends of the radius and ulna puſhed forward and drawn up upon the humerus, we are under the neceſſity of extending the arm while in a ſtraight poſition, as in this caſe the heads of theſe bones are puſhed back upon the anterior part of the humerus on the leaſt attempt to bend them. The extenſion ſhould be continued till the ends of both bones are pulled ſomewhat lower than the moſt depending point of the humerus, when they will either regain their ſituation by the action of the muſcles, or be eaſily forced into it.

In lateral diſlocations of theſe bones, the extenſion muſt alſo be continued till they have clearly paſſed the end of the humerus, when by moderate lateral preſſure they will for the moſt part be eaſily replaced. Of whatever kind the diſlocation may be, the extenſion ſhould be made by aſſiſtants graſping the arm immediately above the wriſt; and while they are thus employed, much advantage may be gained by the ſurgeon preſſing down the heads of the bones.

In two caſes of diſlocation of theſe bones, where their heads were drawn up upon the back of the humerus, the reduction was not accompliſhed, although a great force was applied, not only in pulling at the under part of the arm, but in puſhing down the heads of the diſplaced bones. In one of them, where the olecranon was puſhed through the teguments, that part of the bone was ſawn off, by which the reduction was effected: In the other, this expedient was not adviſed; and the practitioner finding all his efforts to reduce the bones prove abortive, the limb was amputated. As the extenſion in both was applied while the arm was ſtretched out, and as I have never failed in ſimilar caſes where the arm was bent, I conclude, that in the one the arm would have been ſaved, and in the other the joint preſerved entire, if this practice had been adopted.

The reduction being completed, the fore-arm ſhould be kept in a relaxed poſition, by keeping the elbow moderately bent.

Theſe bones, when reduced, do not readily fall again out of their place; but it is proper in this, as in every caſe of luxation, to preſerve the limb as much at reſt as poſſible till the injured parts have recovered their tone.

The bones of the fore-arm are alſo liable to be diſlocated in their connection with each other. At the joint of the elbow a projecting part of the radius is lodged, and moves in a correſponding cavity of the ulna; and below, a portion of the ulna is received by a ſimilar cavity in the radius. Inſtances have occurred of theſe bones being ſeparated from each other at both theſe points of connection; but any ſeparation of this kind is more apt to happen at the wriſt than at the elbow. It is known to have occurred, by all the uſual ſigns of luxations: By pain, ſwelling, and diſtortion in the injured part; by the motion of the joint being impaired; and by manual examination.

In general, the diſplaced bone is eaſily put into its ſituation; but for the moſt part we find it difficult to retain it. The moſt certain method of effecting this, is, to put a long firm ſplint along the outſide of the arm from the elbow down to the points of the fingers, and another of the ſame length on the inſide; the whole to be ſecured with a flannel roller, and the arm hung in the ſling repreſented in Plate XCIX. fig. 2. By this we prevent the rotatory motion of the radius, and the pronation and ſupination of the hand; and if this is guarded againſt for a ſufficient length of time, a cure may at laſt be expected, while want of attention to this is frequently the cauſe of the joint at the wriſt remaining ſtiff for life; of which I have met with various inſtances.

SECTION XI.

Of Luxations of the Bones of the Wriſt.

THE bones of the wriſt are not ſo frequently luxated as might be expected from the ſmallneſs of their ſize, owing to their being firmly connected by ligaments; as well as to the ſtrength which they derive from the whole tending to form a kind of arch; the convex part of which being on the outer or back part of the hand, where it is moſt expoſed to injuries, is particularly well calculated for preventing any of the bones from being diſplaced.

Degrees of force, however, are ſometimes applied to them which they are unable to reſiſt. From their form, it will appear, that they will moſt readily be diſlocated outward. The three ſuperior carpal bones, which form a kind of projecting head, that is lodged in a ſuperficial cavity in the under extremities of the ulna and radius, may either be diſlocated at this joint, or they may be ſeparated from the five inferior bones of the wriſt. In ſome inſtances, one or more of theſe bones are ſeparated from each other; and in others they are diſlocated at their connection with the bones of the metacarpus and the ſuperior bone of the thumb.

As theſe bones are not thickly covered with ſoft parts, the nature of the injury becomes immediately obvious: But in ſome caſes, where perhaps a ſingle bone is only partially diſplaced, if the parts be not examined with attention, the ſymptoms that occur are apt to be attributed to a ſprain; and the real cauſe of them being overlooked, a permanent lameneſs is thus induced, which with much eaſe might have been prevented. Of this I have met with various inſtances. Similar occurrences, however, may always be prevented by an early and attentive examination of the injured parts.

In reducing luxations of theſe bones, we are in general deſired to ſtretch the arm and hand upon a table, and while they are in this poſition, to puſh them into their ſituations: But it is better to have the arm and hand ſupported by two aſſiſtants, as in this ſituation the ſurgeon gets ready acceſs to both ſides of the wriſt. The aſſiſtants ſhould be deſired to keep the parts ſufficiently firm, but not to ſtretch them; and when in this ſituation, the ſurgeon will ſeldom find it difficult to puſh the bones into their places. They muſt be retained by ſplints and bandages in the manner mentioned in the laſt ſection; and as diſlocations of theſe bones are very apt to induce inflammation of the ligaments and other contiguous ſoft parts, repeated applications of leeches ſhould be adviſed as the moſt certain preventive.

SECTION XII.

Of Luxations of the Bones of the Metacarpus, and Fingers.

WE have ſeen in the laſt ſection that the metacarpal bones may be diſlocated at their junction with the bones of the wriſt; and they are ſometimes diſplaced at their under extremities, where they are connected with the bones of the fingers. They are not ſo frequently luxated, however, as at firſt view might be expected; probably from the joint of the wriſt being ſo moveable, that the whole hand readily yields to any force that is applied to it.

The bones of the fingers and thumb are alſo ſometimes luxated; but we likewiſe conſider the mobility of theſe bones as the principal reaſon of their being leſs frequently diſlocated than many of the largeſt and ſtrongeſt bones that are more firmly connected together.

Diſlocations of theſe bones are eaſily diſcovered by all the uſual ſymptoms of luxations; but particularly by the deformity which they produce, which in this ſituation is always conſpicuous.

When any of the metacarpal bones are diſplaced at their connection with the bones of the wriſt, the beſt method of reducing them is, by keeping the arm ſteadily fixed, and puſhing them from above downward, while the hand remains looſe and moveable. When the firſt phalanx of any of the fingers is moved from its junction with the correſponding metacarpal bone, it is to be replaced by one aſſiſtant fixing the hand, while another draws down the diſlocated finger, which ſhould be done by graſping the firſt phalanx only, in order to prevent the other joints of the finger from being hurt. Diſlocations of all the other joints of the fingers, as well as of the thumbs, are to be managed in the ſame manner.

In the reduction of theſe diſlocations, the bone ſhould not be pulled down till it is ſomewhat raiſed or elevated from the contiguous bone; for as all the bones of the fingers and thumbs, as well as thoſe of the metacarpus, are thicker at their extremities than in any other part, theſe projections are apt to be forced againſt each other when the extenſion is made in a ſtraight direction. In this manner the greateſt force has frequently been employed in vain; nay, fingers have been amputated where this alone prevented luxations from being reduced, and in which a very inconſiderable force would have proved ſucceſsful, if the diſplaced bone had been ſomewhat ſeparated from the other before any force was applied for extending it.

SECTION XIII.

Of Luxations of the Femur at the Hip-Joint.

THE ſocket or acetabulum, formed by the oſſa innominata, for lodging the head of the thigh-bone, is ſo deep; the brim of the ſocket in a recent ſubject contracts ſo much about the neck of this bone; the head of the bone is ſo firmly tied down to the bottom of the ſocket by a ſtrong ligament; and it is ſo confined by ſtrong muſcles, that we would not à priori ſuppoſe that it could be luxated by external violence: We would rather imagine that it would break at the neck where it is weakeſt, than that the head of it ſhould ever be forced from its ſocket: This opinion has accordingly been adopted by many in all ages. For a conſiderable

able time I was diſpoſed to favour it, from having obſerved ſeveral caſes which at firſt were ſuppoſed to be luxations, but which proved to be fractures of the neck of the femur. In the courſe of the laſt few years, however, I have ſeen ſeveral caſes in which I was convinced that the thigh bone was luxated. The nature of the ſymptoms gave reaſon to imagine that they aroſe from luxations; and they were proved to do ſo by the patient's being inſtantaneouſly and completely relieved, and rendered quite able to walk, on the head of the bone being replaced; which in a fracture of the bone could not happen.

In treating of fractures of the thigh-bone, the circumſtances by which fractures of the neck of it may moſt readily be diſtinguiſhed from luxations, were mentioned: I ſhall therefore refer for this part of our ſubject to the eleventh Section of the preceding Chapter.

It is ſaid by authors, that the head of the femur may be luxated in various directions, namely, upward and backward, upward and forward, downward and backward, downward and forward, and I may add directly downward. That all of theſe may happen, I cannot take it upon me to deny; but I believe few practitioners have met with an inſtance of the firſt and third. The ſecond variety, where the head of the bone paſſes up upon the os pubis, may happen; as may likewiſe the laſt, where it is forced directly down; but I have never ſeen any variety of this luxation if it be not that in which the head of the femur is puſhed downward and forward, and lodged in the foramen ovale. All practitioners admit, that the bone is moſt frequently diſlocated in this direction; and an examination of the ſkeleton, as well as of the recent ſubject, will ſhow why it ſhould be ſo. The brim of the ſocket over all the upper and back part of it, is not only ſtronger, but more elevated than the reſt of it. It falls away as it deſcends; and on the anterior under part of it there is a conſiderable vacancy in the bone, the ſpace being filled with a ligament only; and as this opening is ſufficiently large to admit the head of the femur, we eaſily ſee how luxations ſhould be moſt apt to occur here.

Every luxation of the femur muſt be productive of lameneſs, and of pain, tenſion, and other ſymptoms with which other luxations are accompanied. When the head of the bone paſſes upward and backward, the leg muſt be much ſhorter than the other; inſomuch that the points of the toes only will touch the ground when the patient is ſtanding upon the other foot; the great trochanter of the thigh-bone will be higher than in the other ſide; the knee and foot turned inward; and a good deal of pain muſt be induced by every attempt to turn them out.

When the femur is luxated upward and forward, the leg muſt be ſhortened; the head of the bone will be felt reſting above the os pubis in the groin; the great trochanter will be on the upper and anterior part of the thigh near the groin, while a vacancy is diſcovered in that part of the hip which it ought to occupy; the knee and toes will be turned outwards; and if the diſlocation be not ſoon reduced, pain, tenſion, and inflammation, will occur in the ſpermatic cord and teſtis, from the preſſure made upon the cord by the head of the bone.

If ever this bone is luxated downward and backward, the leg will be conſiderably longer than the other; the knee and toes will be turned inward; and the great trochanter will be much lower than the ſame protuberance of the other limb. When the head of the bones paſſes directly downward, the leg will alſo be longer than the other, and the trochanter will likewiſe be lower; but the knee and toes will retain nearly their natural ſituation; only every attempt to move them will be productive of pain.

In the moſt frequent luxation of the femur, the leg appears to be conſiderably longer than the other; the knee and points of the toes are turned outward, nor can they be moved either farther outward or inward but with much pain: all the muſcles in the internal part of the thigh are tenſe and painful; the femur cannot be felt on the outſide farther up than the middle of the thigh; a vacancy is diſcovered in the uſual ſeat of the great trochanter, which is found farther down and on the anterior part of the thigh, while the head of the femur is plainly felt a little below the groin; being ſeated, as I have obſerved above, in the foramen ovale.

In luxations of the femur, the difficulty and uncertainty of reducing them has been conſidered as ſo great, that in general we have been adviſed to give a very doubtful prognoſis of the event. In caſes of long duration, this ſhould always be done: For beſides other cauſes which add to the difficulty of reduction, the muſcles here are ſo ſtrong that they reſiſt, in the moſt powerful manner, every attempt to diſlodge the head of the bone after it has been long fixed among them: by contracting round the neck of the bone, they muſt even be torn aſunder before it can be reduced: But in recent luxations we have not this difficulty to encounter; and we know that with proper management the bone may in almoſt every inſtance be reduced.

The reduction of this bone is commonly attempted by pulling the limb downward; and it ſeems to be an opinion very univerſally received, that any force we employ ſhould be applied in this direction. Some adviſe the limb to be drawn directly down from the part in which the head of the bone is lodged; others deſire it to be pulled exactly in a line with the hip-joint, while others turn the knee ſomewhat inward. The patient being placed upon his back, and properly ſecured, the limb is extended in one or other of theſe directions, either till the reduction is accompliſhed, or till ſuch a force is applied as makes the operator afraid of doing harm were he to proceed farther.

It muſt be allowed, that diſlocations of the femur have in various inſtances been reduced in this manner: It might often ſucceed where the head of the bone is forced upwards; but I may without heſitation aſſert, that even in this caſe the reduction might be effected with leſs force in a different manner; and in a great proportion of caſes, where the head of the bone is lodged in the foramen ovale, or where it is forced directly downwards, that we muſt neceſſarily fail entirely by confining the line of extenſion to any of the directions I have mentioned.

In whatever way the head of the femur is luxated, it muſt paſs over ſome inequalities or prominent parts of the contiguous bones: Theſe it muſt again paſs over before it is reduced; at leaſt this muſt be the caſe if we wiſh it to return by the ſame route, and it will be admitted in the treatment of luxations to be a good general rule, to endeavour to replace the bone by the opening at which it paſſed out. But where the limb is only pulled downward in the uſual way, the head of the bone will be forced againſt the projecting brim of the ſocket, if the diſlocation is upward; or it will be drawn to a ſtill greater diſtance from the joint where the bone is diſlocated either directly downward, or lodged in the foramen ovale in the upper and inner part of the thigh. Wherever the head of the bone may be lodged, it ſhould be completely raiſed above any projecting part of the contiguous bones before any other attempt is made for reducing it. As this will remove the principal impediment to the reduction, if the muſcles of the limb are at the ſame time relaxed, it will eaſily be drawn into the ſocket when the diſlocation is upward, or puſhed into it where the head of the bone is already beneath it.

In the moſt frequent variety of this luxation, where the head of the bone is puſhed downward and forward, I have ſucceeded in the following manner: The patient is laid upon his back acroſs a bed, and firmly ſecured by two or three aſſiſtants: A broad ſtrap, or table-cloth, properly folded, is paſſed between his thighs, and over the groin on the ſound ſide, and given to two other aſſiſtants: A ſimilar ſtrap is paſſed round the luxated thigh as near as poſſible to the head of it; the ends of which muſt be given to an aſſiſtant ſtanding on the oppoſite ſide: The belt repreſented in Plate LXXXIX. fig. 3. being previouſly fixed upon the under part of the thigh, the ſtraps connected with it are given to an aſſiſtant or two, while the knee is ſupported by another aſſiſtant with the leg moderately bent. The thigh is now to be moderately ſtretched by the aſſiſtants who have the charge of the ſtraps at the under part of it; but the extenſion ſhould not be carried farther than what may be conſidered as neceſſary for drawing the head of the bone down to the under part of the foramen ovale; and this may be always done with a moderate force. The ſtrap round the top of the thigh muſt now be firmly pulled by thoſe who have the charge of it; who, ſtanding ſomewhat higher than the patient, ſhould draw the thigh upward and inward; and the extenſion ſhould be continued in this direction till there is reaſon to ſuppoſe that the head of the bone is clearly raiſed from the foramen in which it was lodged. At this time the perſon who has the charge of the knee ſhould be deſired to move it ſomewhat inward, and to puſh the head of the bone upward and obliquely outward: He will do this with the greateſt certainty of ſucceſs, if he ſecures the knee with one hand, and the foot with the other, at the ſame time that he takes care to keep the leg juſt ſo much bent as may relax all the flexor muſcles without ſtretching the extenſors. If the different aſſiſtants perform their parts properly, the firſt attempt will anſwer; but if any of them have failed, particularly if the head of the bone has not been ſufficiently raiſed from the hollow in the foramen ovale before being puſhed upwards, the attempt muſt be repeated.

As the head of the bone may for the moſt part be felt outwardly, the ſurgeon may in general aſcertain with certainty whether it is ſufficiently raiſed or not. If he finds it riſe eaſily, the force may be continued till it appears to be about an inch higher than when it was firſt applied; while, on the contrary, if it yields with difficulty, there will be reaſon to ſuſpect that ſome part of the head of the bone is fixed or locked in the upper part of the foramen ovale; in which caſe the force in this direction ſhould be diſcontinued, and the other aſſiſtants at the knee being directed to increaſe the extenſion downward, it will afterwards be more eaſily raiſed.

In whatever direction the bone may be diſlocated, the point requiring moſt of our attention, is the raiſing the head of the bone ſufficiently before any attempt is made to force it into the ſocket. This being accompliſhed, a very ſlight force will in general draw it down when the diſlocation is upward; and when diſlocated downward, whether it is ſomewhat backward or directly on a line with the ſocket, it will be eaſily puſhed up.

In this manner recent luxations of this joint may for the moſt part be reduced; and the ſame treatment is perhaps the beſt even in luxations of long duration. In theſe it will ſometimes fail; but it will ſucceed, I believe, as frequently as any other that has yet been propoſed, while it is not productive of the dreadful pain that commonly enſues from the uſe of thoſe machines that have been invented for a greater extenſion of the limb. When any additional force, however, is judged neceſſary, it may either be obtained by a proper application of Mr Freke's machine, repreſented in Plate XC., of Mr Petit's in Plate LXXXVIII. fig. 2., or of the pullies and ropes repreſented in Plate LXXXIX. fig. 2.

It ſhould be remarked, however, that this kind of aſſiſtance can never be applicable where the luxation is downward. Extenſion of the limb having been conſidered as neceſſary in every variety of luxation, it has often been indiſcriminately employed, whether the head of the bone was placed above or below the ſocket: It is obvious, however, that it is in the former only that it can ever prove uſeful; and in the latter, that much miſchief may enſue from it.

The violent diſtenſion of the muſcles, and extenſive laceration of the articular ligaments, with which luxations of this bone muſt always be accompanied, render much care and attention neceſſary long after the reduction is accompliſhed. Local blood-letting with leeches, or cupping and ſcarifying, proves particularly uſeful here, and ſhould be repeated more or leſs frequently according to the violence of the ſymptoms, and age and habit of the patient; and till the parts may be ſuppoſed to have recovered their tone, the patient ſhould be kept as much at reſt as poſſible.

By many it is imagined that the femur may be partially luxated; and the appearances which are ſuppoſed to ariſe from what is termed a Subluxation of this bone are deſcribed by authors: Of theſe, however, I have taken no notice, as it is not my opinion that this bone can ever be partially luxated. The head of it is ſo round, and the brim of the ſocket ſo narrow, that whoever examines them will be convinced that it cannot happen. The head of the bone may, in a gradual manner, be puſhed out of the acetabulum by a tumor at the bottom, but I do not ſuppoſe that it can ever occur from external violence.

SECTION XIV.

Of Luxations of the Patella.

THE Patella may be either partially or completely luxated, and it may be diſplaced either upward or downward, outward or inward: It may alſo be luxated by itſelf, or it may be diſplaced along with the tibia and fibula in luxations of theſe bones. It cannot, however, be completely luxated in any direction, if it be not accompanied with a rupture of the ligament by which it is tied to the tibia, or of the tendon of the rectus muſcle connected to the upper part of it; and it will be more readily diſlocated inwardly than in any other direction, owing to the internal condyle of the femur being ſomewhat leſs prominent than the other: For as this bone is placed in ſome degree between theſe condyles, it will neceſſarily be moſt eaſily forced out at that ſide where it meets with the leaſt reſiſtance.

Luxations of this bone are, for the moſt part, eaſily diſcovered, as it is thinly covered with ſoft parts: But when it has been long diſplaced, it is apt to induce ſo much tumefaction, not only about the joint, but over all the contiguous parts, as to be diſtinguiſhed with difficulty. Even the moſt partial luxation of the patella always gives conſiderable lameneſs and much pain on every attempt to move the joint.

In the reduction of a luxated patella, the patient ſhould be placed either on a bed or on a table, and his leg ſhould be ſtretched out and kept in this poſture by an aſſiſtant. The ſurgeon ſhould now lay hold of the bone, and endeavour to puſh it into its ſituation; but inſtead of puſhing it directly forward, it ſhould firſt be ſomewhat raiſed, otherwiſe we are apt to force it againſt the condyles of the femur or head of the tibia. The beſt method of effecting this is to preſs down the ſide of the bone moſt diſtant from the joint; by which the oppoſite ſide of it will be elevated, when a very moderate force will preſs it into its place. When the patella is drawn out of its ſituation by the tibia and fibula being diſplaced along with it, it cannot be replaced till the reduction of theſe bones is accompliſhed.

SECTION XV.

Of Luxations of the Tibia and Fibula at the Joint of the Knee.

THE tibia is the only bone of the leg that is immediately concerned in the joint of the knee; but as this bone cannot be diſlocated without drawing the fibula along with it, I think it right to mention them together.

As more ſtrength is required in the knee than in any other joint of the body, the bones of which it is chiefly formed, the femur and tibia are connected together by the ſtrongeſt kind of articulation, namely by Ginglimus or the Hinge-like joint: The ſurfaces of the two bones are very extenſive, and they are firmly tied together by ſtrong ligaments: There is alſo reaſon to ſuppoſe, that the moveable cartilages placed between the ends of theſe bones have ſome influence in leſſening the friction of the joint, and in thus rendering it more firm than it otherwiſe would be.

The great ſtrength of this joint is the reaſon of its being leſs frequently diſlocated than any other in the body: It cannot indeed be completely diſlocated but by the application of ſo much force as will not only rupture the teguments which cover it, but the ſtrong ligaments and tendons which tie the bones together. As this requires a very unuſual degree of violence, theſe bones are ſeldom forced entirely paſt each other; and the ſame reaſon even prevents them from being often partially luxated. When either a complete or partial luxation, however, is produced, it may happen nearly with equal eaſe on either ſide; but the bones will be more readily forced backward than forward, owing to the flexor muſcles and tendons of the leg being much ſtronger than the extenſors.

The moſt partial luxation of this joint is readily diſtinguiſhed, not only by the violent pain which it excites, and the lameneſs with which it is attended, but by the deformity which it produces, and which is always obvious on comparing both knee-joints together.

When the patella is diſlocated at the ſame time with the tibia and fibula, it will, for the moſt part, be reduced along with theſe bones; but when this does not happen, it may be afterwards replaced in the manner I have mentioned in the laſt Section.

Luxations of this joint are to be reduced by fixing the thigh with ſufficient firmneſs, and extending the leg till the ends of the bones are entirely clear of each other; when the tibia and fibula will be eaſily replaced. In partial luxations, the degree of extenſion neceſſary for this will be inconſiderable; but where the bones are completely diſplaced, more force will be required. It is ſcarcely neceſſary to obſerve, that the muſcles of the leg ſhould be as much relaxed as poſſible while the force for extending it is applying.

Scarcely any joint is ſo apt to ſuffer from inflammation as that of the knee; ſo that in all ſuch injuries as this, where the ſurrounding ſoft parts are ſo liable to inflame and become painful, the moſt ſtrict antiphlogiſtic courſe becomes requiſite; local blood-letting ſhould be preſcribed, and repeated according to the violence of the ſymptoms and ſtrength of the patient; and the limb ſhould for a conſiderable time be kept at perfect reſt.

The upper as well as the under end of the fibula is ſometimes forcibly ſeparated from the tibia. As the ſymptoms which this excites are ſimilar to thoſe which occur from ſprains of the muſcles, the nature of the injury is often overlooked. I may almoſt always, however, be diſtinguiſhed by attentive manual examination.

The only method of obtaining relief is by replacing the bone, which for the moſt part is eaſily done, and retaining it with a proper bandage till the parts have recovered their tone.

SECTION XVI.

Of Luxations of the Foot at the Joint of the Ankle.

THE joint of the ankle is formed by the upper part of the aſtragalus or firſt bone of the foot, being received into a cavity in the under end of the tibia; which is bounded externally by the end of the fibula projecting a conſiderable way paſt the end of the tibia.

The aſtragalus may be diſlocated either backward or forward, outward or inward, but it is more frequently puſhed inward than in any other direction. The great ſtrength of the tendo achillis prevents it from ſlipping eaſily backward, and it has alſo ſome effect in preventing it from going forward. It cannot be puſhed outward without breaking the projecting end of the fibula.

Diſlocations of this joint are in general eaſily diſcovered by the pain and lameneſs which they produce, as well as by the obvious alteration which they occaſion in the appearance of the foot. When the aſtragalus is puſhed forward, the foot appears to be lengthened and the heel ſhortened; when puſhed backward, the foot is ſhortened and the heel lengthened; and when luxated, either outwardly or inwardly, there is always a preternatural vacancy on one ſide of the joint, and a prominency on the other.

In the reduction of this luxation, the patient ſhould be placed either upon a table or on a bed, and the leg, with the knee bent, ſhould be firmly ſecured by an aſſiſtant or two. The foot is now to be put into that ſituation which tends moſt effectually to relax all the muſcles that belong to it; and being given to an aſſiſtant, he muſt be deſired to extend it in that direction till the moſt prominent point of the aſtragalus has clearly paſſed the end of the tibia, when the bone will either ſlip into its place, or may be eaſily forced into it.

As the upper part of the aſtragalus is not perfectly round, but rather ſomewhat hollow, this joint is more apt to be partially luxated than any other formed by a ball and ſocket, as this in ſome meaſure is: Partial luxations of it, however, are eaſily reduced.

Beſides the antiphlogiſtic courſe that I have adviſed after all luxations of the large joints, it is particularly neceſſary in luxations of the ankle to keep the limb for a conſiderable time at the moſt perfect reſt, eſpecially where the under extremity of the fibula is broken, by the foot being forced outward; for, as the ſtability of the joint depends in a great meaſure on this bone, if it be not either rightly replaced or retained in its ſituation, till the cure of the fracture is effected, it may afterwards continue weak during life, or be attended with ſtiffneſs and a great degree of pain. The weakneſs that ſucceeds to this kind of injury, if it be not removed by theſe meaſures, will be moſt effectually obviated by a firm ſplint of thin iron connected with the ſhoe, and applied along the outſide of the leg; or by an inſtrument invented by the late Mr Gooch, repreſented in Plate XCII. fig. 4.

SECTION XVII.

Of Luxations of the Os Calcis and other Bones of the Foot.

THE os calcis, which is the largeſt bone of the foot, is ſometimes diſlocated laterally, where it is connected with the aſtragalus. It is prevented from being puſhed forward by the other bones of the foot; and the tendo achillis, which is inſerted into a large rough proceſs of this bone which projects backward and forms the heel, prevents it from being luxated in this direction.

The aſtragalus and os calcis are ſometimes luxated at their junction with the os naviculare and os cuboides; and as this joint, if it may be ſo termed, is at no great diſtance from the ankle, this variety of luxation has, in ſome inſtances, been miſtaken

taken for luxation of the ankle. The foot may at this part be puſhed either outward or inward, or be forced directly downward: It will rarely be luxated upward, as it can ſcarcely be expoſed to external violence in ſuch a direction as could have this effect.

Luxations of any of theſe bones are readily diſcovered by the pain and lameneſs with which they are always attended; as well as by the alteration which they produce on the ſhape of the foot.

The os calcis, when completely diſplaced, is more difficult to reduce than almoſt any other bone of the foot: It can only be done by fixing the leg and foot in ſuch a poſition as tends moſt effectually to relax the different muſcles that belong to them; and while they are in this poſition, by endeavouring to force the bone into its ſituation; and this will be more readily done, if during the operation the foot is extended.

In luxations of the aſtragalus and os calcis with the os naviculare and os cuboides, as the anterior part of the foot is apt to be drawn towards the heel, it becomes neceſſary to extend it to ſuch a degree as may clear the bones on the oppoſite ſides of the joint of each other; for till this is done, the reduction cannot take place, while the bones will immediately ſlip into their ſituation as ſoon as they are drawn paſt each other.

The other three bones of the tarſus, uſually termed the Cuneiform Bones, as well as the Metatarſal Bones, and the Bones of the Toes, are all liable to be luxated, and they may be diſplaced almoſt in every direction. But it is not neceſſary to ſpeak of the method of reducing them; for the obſervations that I had occaſion to make on diſlocations of the bones of the hand are equally applicable here: ſo that I ſhall now refer to what was ſaid on that ſubject in the twelfth Section of this Chapter.

CHAPTER XLI.

Of DISTORTED LIMBS.

LIMBS may be diſtorted in various ways, and by different cauſes; either from a morbid ſtate of the bones, or from a contracted ſtate of the muſcles, or the bones and muſcles may both be affected. In ſome caſes, diſtortions are owing to original mal-conformation; in others, they ariſe in infancy, and in ſome, at more advanced periods of life.

For a conſiderable time after birth, the bones are ſoft and pliable, and are eaſily affected by the poſtures of the body. The bones of the legs are apt to be crooked by children being made to walk too early. This alſo is the effect of ſome diſeaſes, particularly of rickets, which ſoften the bones ſo much that they eaſily yield to the poſture of the body, as well as to the ordinary action of the muſcles. But the moſt frequent cauſe of diſtorted limbs is that contraction of the flexor muſcles of the leg and fore-arm, which is often induced by an inflamed ſtate of the knee and elbow, and of which we have a very common example in thoſe caſes of white ſwelling to which theſe joints are more particularly liable. As the limb lies in greateſt eaſe while the muſcles are relaxed, the patient naturally keeps it always bent; and when this poſture is long continued, it almoſt conſtantly terminates in ſuch a contracted ſtate of the flexor tendons, as keeps the under part of the limb at an angle with the ſuperior part of it: Of this we meet with daily inſtances in the leg; where from this cauſe alone a patient is often altogether deprived of the uſe of his limb.

As it has been a prevailing opinion among practitioners, that little advantage is to be derived from any remedies that we can employ for diſtorted limbs, they have ſeldom made any attempt to cure them: In conſequence of which, this branch of practice has been almoſt univerſally truſted to itinerants or to profeſſed bone-ſetters. In this, however, we are wrong; and in ſaying ſo, I can ſpeak with confidence, founded on much experience: Having early in life obſerved the miſery to which patients with diſtorted limbs were reduced, I was reſolved to make ſome attempts for the relief of ſuch as might apply to me, however ſmall the chance might be of ſucceeding; and in various inſtances I have had the ſatisfaction of relieving, and in ſome caſes of curing completely, patients who had been lame for ſeveral years, and where it was not expected that any thing could be done for their advantage. Where an anchyloſis is formed by the ends of two bones forming a joint having adhered together, it would be in vain to make any attempt to remove it, unleſs the inconvenience attending it were uncommonly great: In which caſe, if it were the patient's deſire, this might be a reaſon for amputating the limb; or in particular inſtances, it might be removed by taking out the ends of the bones forming the joint, and allowing the newly-divided ends of them to unite to one another: But when the ſtiffneſs of a joint depends on a contracted ſtate of the muſcles and tendons that ſerve to move it, by much the moſt frequent cauſe of diſtorted limbs, we may almoſt in every inſtance afford relief by more ſimple means; and where a limb is crooked by a bone being bent, whether it may have happened from improper management during childhood, or as the effect of rickets or any other diſeaſe, we may very commonly, by timous attention, either remove it entirely, or render it much leſs conſiderable.

Where a limb is diſtorted from a ſtiff contracted ſtate of the muſcles and tendons that belong to it, a free uſe of emollients, with moderate gradual extenſion, is the remedy from which I have derived moſt advantage, and which never in any inſtance does harm. Thoſe who have not been in the practice of uſing emollients for this purpoſe, may imagine, that they will not penetrate to the depth of the muſcles and tendons; and when I firſt employed them, I muſt own, that I did not expect they were to do ſo in any remarkable degree: But, knowing no other remedy that was likely to lubricate ſo effectually parts that were become ſtiff, I was reſolved to give them a complete trial; and I was ſoon convinced of their utility: When the Treatiſe on Ulcers was firſt publiſhed, I had occaſion to mention this, and ſince that period very ample opportunities have occurred of employing the ſame remedy with advantage.

In order, however, to gain this end, emollients muſt be uſed with great freedom. All the contracted muſcles and tendons, from their origin to their inſertion, muſt be well rubbed for at leaſt half an hour three times a-day; and the limb ſhould be kept conſtantly moiſt with, or as it were immerſed in, the emollient, by being covered with flannel well ſoaked in it at every repetition of the frictions. While the frictions are applying, the limb ſhould be ſlowly, though firmly, extended to as great a degree as the patient can eaſily bear; and the inſtrument repreſented in Plate XCI. may be afterwards applied, in order to prevent the muſcles from contracting.

It is neceſſary, however, to remark, that this extenſion ſhould not be made quickly: By doing ſo, much harm has been done, inſomuch that joints have become pained and inflamed, where there was not previouſly any other diſeaſe than ſtiffneſs of the flexor muſcles; while it may be done with the utmoſt ſafety in the gradual manner I have mentioned. In the one way, indeed, ſeveral months may be required for effecting what a greater force might accompliſh in as many weeks; but the latter muſt always be attended with pain and hazard, while with the other we proceed with eaſe and ſafety.

Even where extenſion is not neceſſary, the effects of emollients are often conſpicuous. We frequently meet with ſtiff joints, particularly in the ankle, without any contraction or diſtortion of the limb. In this caſe, emollients alone, if duly continued, will commonly relax them ſufficiently.

Every kind of greaſy application proves uſeful here, but animal fats anſwer better than vegetable oils. The greaſe of geeſe and ducks and other fowls anſwers well; alſo hogs-lard, and the oil obtained from boiling recent bones of beef and mutton in water. Butchers uſually keep this oil in quantities: When properly prepared, it is quite pure and tranſparent, and has no ſmell.

When the diſtortion of a limb proceeds from a bone being bent, if this is not of long duration, and eſpecially when it occurs in childhood, we may frequently remove or leſſen it by conſtant preſſure gradually increaſed on the convex ſide of the limb, till the bone is brought into its natural direction.

This kind of deformity often occurs in patients labouring under rickets; but we find it moſt frequent in new-born children, either from original mal-conformation, or from ſome ſingularity in the ſituation of the child while in the womb. It is moſt frequent in the legs, when it alſo affects the direction of the feet and ankles. When the bones of the leg are bent outward, the foot is turned inward; and, vice verſâ, the foot is turned outward when the leg is bent inward. Patients affected in this laſt manner are called Valgi; and Vari when the feet are turned inward.

Theſe diſtortions of the feet and ankles, have been ſuppoſed to originate in almoſt every inſtance from mal-conformation in the bones forming the joint of the ankle; and the means that have been propoſed for removing them, have been meant to produce an alteration of that joint: They may in ſome caſes ariſe from this cauſe, but I have ſcarcely met with it. At firſt view of the diſeaſe, we are indeed apt to imagine that the fault lies chiefly in the ankle; but it will be very univerſally found, as I have juſt obſerved, to proceed from the form of the leg. When the leg is bent outward, the toes are turned inward, and the ſide of the foot downward; or, if the curvature of the leg is conſiderable, the ſole of the foot will be turned nearly altogether upward, while the top of the foot will reſt on the ground on every attempt to walk: And, on the contrary, when the bones of the leg are bent inward, the toes and ſole of the foot will be turned outward and upward.

Whoever will examine with attention the effect produced upon the foot by the bones of the leg being curved in the manner I have deſcribed, will find, that the maladies we are now conſidering muſt neceſſarily reſult from it; and although it may occaſionally happen, that the joint of the ankle is affected by a long continuance of the diſtortion, yet in almoſt every inſtance, the diſeaſe will be found to proceed originally from the cauſe I have mentioned: So that in the cure, our views ſhould be chiefly directed to this affection of the leg. By removing the curvature of the bones, the foot will gradually regain its natural ſituation, while all our endeavours will fail, if we only attempt to alter the direction of the ankle-joint.

When the foot and toes are turned inward, ſolely from a mal-conformation of the ankle-joint, we ought no doubt to endeavour to give the joint a better direction; but as I never met with an inſtance of this, I muſt leave the particular mode of effecting it to thoſe who may happen to ſee it. The beſt method of applying preſſure to the bones of the leg when bent, is by fixing a firm ſplint of iron in the ſhoe, on the concave ſide of the leg; and if the head of the ſplint be made to reſt againſt the correſponding condyle of the femur, and the other end of it on the foot, an eaſy gradual preſſure may be made upon the oppoſite ſide of the leg, by one or two broad ſtraps paſſed round both the leg and the ſplint. If the ſplint is covered with ſoft leather, and properly fitted to the parts, it gives no uneaſineſs; and by drawing the ſtrap ſurrounding it with the leg tighter from time to time, the preſſure is increaſed in the gradual manner I have mentioned. In Plate XCII. figures 1, 2. and 3. an apparatus is repreſented; which in different caſes, where the curvature of the leg was very conſiderable, and where the ſole of the foot was turned almoſt entirely upwards, anſwered the purpoſe completely. It proves ſometimes ſufficient to fix the ſmall end of the ſplint in the ſhoe, and the broad flat pad at the top on the condyle of the femur. A ſplint for this purpoſe is repreſented in fig. 2. This gives it two fixed points, by which we have it in our power to make any neceſſary preſſure with the ſtraps paſſed round the leg: But in ſome inſtances, as was the caſe in two of thoſe to which I allude, the ſole of the foot could not be kept ſo much down as to admit of this, without fixing the ſhoe to a frame, as is repreſented in fig. 3., for in all ſuch caſes the ſole of the foot ſhould be kept as much as poſſible in a natural ſituation, otherwiſe the preſſure made upon the leg for removing the curvature in the bones is apt to give a wrong direction to the joint of the ankle, by the under end of the ſplint being neceſſarily made to reſt on it.

I have thus given a general view of the nature of this affection, and of the management beſt adapted for removing it: but whether limbs are diſtorted from a contracted ſtate of the muſcles that belong to them, or from a curvature in the bones, much variety muſt occur in the application of the remedy, particularly in the manner of applying the extenſion. The treatment, indeed, that ſuits one caſe beſt, is ſeldom exactly applicable to another: It muſt therefore be varied according to the judgment of the practitioner.

Other means have been propoſed for removing curvatures in bones: Of theſe the beſt I have ſeen is an invention of a late ingenious artiſt of this place, Mr Gavin Wilſon, who was long much employed in this branch of buſineſs. In Plate XCIII. fig. 1. and 2. I have repreſented one of Mr Wilſon's inſtruments for diſtortions of the leg.

CHAPTER XLII.

Of DISTORTIONS *of the* SPINE.

THE ſpine may be diſtorted in various directions; outwardly, inwardly, and laterally; and in ſome caſes it happens in all of theſe directions in the ſame perſon. This ſometimes ariſes from external violence; but more frequently as a ſymptom of a delicate frame.

Beſides the deformity which theſe diſtortions produce, they are apt to injure the health, by compreſſing the abdominal and thoracic viſcera, and inducing paralytic affections of the lower extremities, in conſequence of the preſſure which they produce on the nerves of thoſe parts. They occur in all ages; but more frequently about puberty than at any other period, and more commonly in girls than in boys. In general, their effects are obſerved before the cauſe is ſuſpected; for there is ſeldom much pain in the diſtorted part.

When diſtortion of the ſpine occurs during infancy, the patient appears to be ſuddenly deprived of the uſe of his limbs; but at more advanced periods, he complains firſt of feebleneſs and languor, and of numbneſs or want of feeling in the under extremities. By degrees this want of ſenſibility is found to increaſe; and he is often obſerved to ſtumble and to drag his legs inſtead of lifting them cleverly, nor can he ſtand erect for any length of time but with much difficulty. At laſt he loſes the uſe of his legs entirely, which become altogether paralytic; and when the ſpine is diſtorted forward, ſo as to compreſs the thoracic and abdominal viſcera, he becomes

comes diſtreſſed with dyſpnœa, or with complaints in the ſtomach and bowels, according to the part of the ſpine that is diſeaſed.

In ſome the loſs of power in the extremities takes place in the courſe of a few days from the firſt approach of the diſeaſe; and it ſometimes becomes gradually leſs, although it never is, ſo far as I have obſerved, entirely removed.

On the deformity being diſcovered, we ſometimes find that one of the vertebræ only is diſplaced: Sometimes two or more are affected; and in ſome caſes it appears to ariſe ſolely from a thickening of the ligaments connecting the vertebræ together, without any particular affection of the bones. When one of the vertebræ only is diſplaced, the patient is uſually more completely deprived of the power of his limbs than when two or more of them are diſplaced, owing perhaps to the angle being more acute, and conſequently the preſſure on the medulla ſpinalis more conſiderable when one bone only is thrown out of the range. This alſo accounts for the paralytic ſymptoms being in ſome inſtances leſs remarkable in more advanced ſtages of the diſeaſe than they were at firſt; for although one bone only may be diſplaced at firſt, yet one or both of the contiguous vertebræ almoſt conſtantly yield at laſt; and the difference ariſing from this is ſo great, that patients almoſt always linger and die in the courſe of a year or two, often in leſs time, when one bone only is deranged; while they live for a great length of time, frequently as long as if no ſuch circumſtance had occurred, when the curvature of the ſpine becomes more extenſive.

As diſtortions of the ſpine often proceed from delicate weakly patients indulging too much in particular poſtures, every habit of this kind ſhould be avoided on the firſt appearance of the diſeaſe. If the patient has been accuſtomed to lean much to one ſide, the reverſe of this ſhould be adviſed; and that the body may lie as much as poſſible upon an equal ſurface during ſleep, he ought to uſe a hair mattreſs laid upon boards inſtead of a bed of feathers or down.

By attention to theſe points; by the uſe of an invigorating diet; the cold bath, bark, and other tonics; the diſeaſe has been in ſome caſes prevented from advancing ſo far as it otherwiſe probably would have done: But where any of the bones have been affected, I have never ſeen an inſtance of a complete cure being obtained. Mr Pott, to whoſe obſervations upon this ſubject we are much indebted, ſpeaks highly of the effect of iſſues placed as near as poſſible to the tumor. He adviſes an iſſue to be opened with cauſtic on each ſide of the tumor, large enough to admit a kidney-bean, and the bottom of the ſore to be ſprinkled from time to time with powder of cantharides. This I have practiſed in various caſes, and in ſome inſtances with obvious good effects: But in all of theſe there was reaſon to ſuppoſe that the ſeat of the diſeaſe was in the ligaments only, and not in the bones of the ſpine. When they have appeared to prove uſeful where the bones have been affected, I conclude that the mitigation of ſymptoms has ariſen from the cauſe I have mentioned, the preſſure upon the ſpinal marrow being leſſened in the progreſs of the diſeaſe.

Various machines have been invented for the removal of diſtortions of the ſpine by preſſure: All of theſe, however, do harm, and ought never to be uſed. It muſt at once appear, to whoever is acquainted with the anatomy of theſe parts, and with the nature of this diſeaſe, that the diſplaced bone is never to be forcibly puſhed into its ſituation; and if this cannot be done, it is obvious that no advantage is to be derived from the practice, while it is evident that much harm may enſue from it.

In all diſtortions of the ſpine, it is an object of the firſt importance to ſupport the head and ſhoulders. If this is neglected, the weight of the head tends almoſt conſtantly to increaſe the curvature.

The collar uſually employed for this purpoſe anſwers nearly as well as any other. In Plate XCIV. fig. 1. a repreſentation is given of one with ſome improvements, by which both the head and ſhoulders may be very effectually ſupported; and in fig. 3. another is delineated for ſupporting the ſhoulders only.

CHAPTER XLIII.

Of NECROSIS.

TILL lately little was underſtood of this very ſingular diſeaſe: Not from its being new, or that it has only lately made its appearance, for it ſeems to depend on cauſes that have probably exiſted equally in all ages; but from its having been confounded with other diſeaſes, from which however it is widely different.

We meet with many detached obſervations on this diſeaſe, in the works of Hildanus, Cheſelden, Gooch, Hunter and others, but my friend Mr Ruſſell was the firſt who gave a regular ſyſtematic account of it: The deſcription indeed that he gives of it is ſo full, clear, and perſpicuous, that ſcarcely any thing new is left for others to add to it *.

The term Necroſis, is derived from the Greek word Νεκρος, Mortuus; in alluſion to one of the moſt remarkable circumſtances of the diſeaſe, which conſiſts in the ſpontaneous death of one bone, and the reproduction of another, the laſt of which is in part formed before the other can ſeparate.

The old bone, which ſeparates, and commonly comes away either diſſolved in the form of matter, or in one or more pieces, is termed the Sequeſtra, and it is always ſurrounded by and included in the new one, ſo that the new bone muſt be larger in circumference, though not longer than the other. This being the caſe, we would naturally ſuppoſe that thoſe tendons of muſcles

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* *Vide* A Practical Eſſay, on a certain diſeaſe of the bones, termed Necroſis, illuſtrated with ſix plates, by James Ruſſell, F. R. S. Surgeon, Edinburgh.

muſcles which were originally inſerted into that portion of the old bone that is now deſtroyed, would completely loſe their influence: But it is quite otherwiſe; for we find, that they poſſeſs their relative ſituation in the newly-formed bone, into which they are inſerted by the oſſification of a gelatinous fluid poured forth around them. The new bone which is thus produced, appears to be poſſeſſed of all the eſſential properties of the original. It is not indeed ſo regular in its external appearance, nor internal ſtructure, for it is not lamellated, but it can ſet out oſſific granulations; it may exfoliate, and it performs all the functions peculiar to an original bone.

From all the experiments and obſervations that have hitherto been made on the ſubject, it ſeems to be probable that the perioſteum is no way concerned in the production of the new bone; that it does not furniſh granulations for its increaſe; that deſtruction of the marrow does not naturally follow an attack of necroſis; but that this proceſs never takes place without a previous ſtate of inflammation.

The ſymptoms attending necroſis are the following: Firſt, There is a deep-ſeated pain in the limb; and inflammation and ſuppuration take place: The matter thus formed diſcharges itſelf in one or more openings in the moſt prominent parts of the limb, and theſe openings communicate with ſinuſes that commonly go to the depth of the bone: The matter for the moſt part is good, though copious, and it cannot be increaſed in quantity by preſſure.

The ſequeſtra is not always diſcovered by the probe, and the ſore ſometimes heals without the former being thrown off; at other times, however, when the inflammation is ſevere, the ſequeſtra is thrown off quickly, which commonly excites a temporary loſs of power of the whole limb: But in general the inflammation is ſlight; the proceſs of ſeparation goes on ſlowly; and the patient retains the motion and uſe of his limb.

In the courſe of the diſeaſe, the ſores frequently heal and break out again, and holes form in the newly-formed bone correſponding with the ſinous openings on the ſurface: It has been found, that in this diſeaſe even joints are regenerated, and in that caſe the cartilage is always larger than in the original ſequeſtra; this has taken place in the lower jaw, where new ſockets are formed for the teeth which have been retained.

The progreſs of necroſis is always tedious; in ſome it will be over in the courſe of a few months; but in a great proportion of caſes it goes on for two or three years.

We chiefly meet with necroſis in infancy and early youth, and more frequently in the lower jaw and in the bones of the leg than in any other part of the body.

The moſt obvious prediſpoſing cauſes of necroſis are lues venerea, and a ſcrofulous diatheſis; and in ſome inſtances we can trace the exciting cauſe to an external accident, as a blow or a bruiſe.

The diſeaſes for which necroſis may be miſtaken are the following: Caries of a bone produced by inflammation or collections of matter without expoſure to the external air; and it may be miſtaken for the exfoliation of an external lamella of a bone: but in the latter the internal ſurface is ſmoother, the matter is thin and fetid, and the granulations leſs firm and more extenſive than in necroſis.

The danger ariſing from necroſis is in a great meaſure to be eſtimated from the degree of inflammation and fever that takes place: It ſeldom proves dangerous, and where theſe ſymptoms are moderate, the patient is able in a great proportion of caſes to conduct his ordinary buſineſs without confinement; but when he becomes hectic, as ſometimes happens, immediate amputation of the limb is perhaps the only remedy to be truſted.

In the cure of necroſis, no general treatment proves of any avail, and there is reaſon to think, when the ſequeſtra ſeparates eaſily, that the interference of art ſhould never be adviſed. If it be not indeed in certain circumſtances, it is perhaps our beſt practice to do nothing in the whole courſe of the diſeaſe but to obviate particular ſymptoms.

When the pain is ſevere, local blood-letting and the general effects of antiphlogiſtic remedies, as I have already obſerved, are to be chiefly depended on. When matter is formed and is found to lodge in any of the ſoft parts of the limb, it ought to be diſcharged by ſmall openings, and the ſtrength of the patient requires to be ſupported by due attention to a well-regulated diet, as otherwiſe it is apt to ſink by the long duration of the diſeaſe.

In this manner a cure is frequently obtained without any farther aſſiſtance from art, that is, the ſequeſtra either diſſolves and comes away inſenſibly in the matter diſcharged from the ſore; or it comes off in one or more pieces; or the irritation that it excites becomes inconſiderable, and the ſores at laſt heal, while the ſequeſtra ſtill continues ſurrounded with the newly-formed bone. The limb is larger than the other, and commonly ſomewhat deformed by inequalities on the ſurface of the bone; but under theſe inconveniencies the patient ſometimes eſcapes without much pain, and with little or no injury to his conſtitution.

It ſometimes, however, happens, that the ſequeſtra does not come away, while at the ſame time it creates ſo much irritation, that fever takes place, by which, and by a profuſe diſcharge of matter from the ſores, the health of the patient is brought into hazard: In this ſituation, an attempt ſhould either be made to remove the ſequeſtra by a chirurgical operation, or immediate amputation of the limb ſhould be adviſed.

If any part of the ſequeſtra appears, it may be right to endeavour to ſave the limb by taking it away; but where no part of the old bone is diſcovered, under all the uncertainty of the exact ſituation and ſtate in which it may be, together with the riſk of increaſing, by this operation the ſtate of irritation over the whole limb, it will probably, in the courſe of further experience, appear to be our beſt practice, in ſuch circumſtances, to adviſe the limb to be amputated.

The operation for removing the ſequeſtra is done in the following manner: A longitudinal inciſion is made through all the ſoft parts covering the diſeaſed bone: In this manner the bone muſt be laid completely bare, but if the teguments are ſound, no part of them ſhould be removed.

If the ſequeſtra is diſcovered by any holes in the newly-formed bone, and if theſe are very near to one another, an opening ſufficiently large for taking it out may be made with a large ſcalpel or a ſharp chiſel and mallet; but it ſhakes the limb leſs, and gives leſs pain to the patient, to do it with reiterated applications of the trephine, and afterwards to cut out with a firm ſcalpel, ſuch ſmall portions of the bone as the ſaw may have left. In the event of no opening in the new bone being met with, ſmall holes may be drilled in it with the perforator of a trepan. In this manner the ſtate of the ſequeſtra may be diſcovered, when by the operation that I have already deſcribed, with the head of the trepan, an opening may be made in the new bone of a ſufficient ſize for removing the other. This, however, as I have already obſerved, is an operation neceſſarily attended with uncertainty and hazard, ſo that in a great proportion of caſes, it will probably be found to be a ſafer practice to amputate the limb.

After the ſequeſtra is removed, mild dreſſings ſhould be applied: emollient poultices and an antiphlogiſtic regimen prove uſeful, while ſymptoms of inflammation take place; by which, and a due attention to regimen, the ſore will heal eaſily, when the health is otherwiſe good: The cure, however, proves always tedious, being ſeldom completed in leſs than ſix months, and as the limb ſhould be kept during the whole period at perfect reſt, and as much as poſſible in the ſame poſition, the confinement is neceſſarily of the moſt diſtreſsful nature.

This, together with the uncertainty and hazard of the operation for removing the ſequeſtra when no part of it appears, makes me conclude, as I have obſerved already, that in all ſuch circumſtances it is perhaps our beſt practice rather to amputate the limb.

CHAPTER XLIV.

Of AMPUTATION.

SECTION I.

General Remarks on the Operation of Amputation.

BY the term Amputation, we uſually underſtand the removal of the whole or part of a limb. We ſpeak of the Extirpation of a tumor; of the mamma; of a teſtis: But we ſay the Amputation of a leg and of an arm.

The mutilation, produced by this operation, renders it one of the moſt dreadful in the practice of ſurgery; yet as the only means by which life can be ſaved,

ved, it is frequently neceſſary. It is an operation, however, ſo repugnant to humanity, ſo diſtreſsful to the unfortunate ſufferer, and in ſome circumſtances ſo fraught with danger, that nothing but a clear conviction of this neceſſity can warrant our propoſing it in any caſe.

The operation, indeed, is not difficult: Every practitioner accuſtomed to handle inſtruments may perform it. But to diſtinguiſh with preciſion the caſes which require it, from thoſe which might do well under a different treatment, and to determine the particular periods of each when it ought to be performed, are circumſtances which require more deliberation than perhaps any other in ſurgery: I ſhall therefore enumerate the cauſes which may render amputation neceſſary, before proceeding to deſcribe the method of performing it.

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SECTION II.

Of the Cauſes which may render Amputation neceſſary.

THIS operation may be rendered neceſſary by various cauſes; all of which may be comprehended under the following heads.

1. Bad compound fractures.

2. Extenſive lacerated and contuſed wounds.

3. A portion of a limb being carried off by a cannon-ball, or in any other manner, if the bones are unequally broken and not properly covered.

4. Extenſive mortification.

5. White-ſwellings of the joints.

6. Large exoſtoſes, whether they are confined to joints, or ſpread over the whole bone or bones of a limb.

7. Extenſive caries, accompanied with bad ulcers of the contiguous ſoft parts.

8. Cancer, and other ulcers of an inveterate nature.

9. Various kinds of tumors.

10. Particular diſtortions of a limb.

11. Necroſis.

Each of theſe cauſes I ſhall conſider in the order in which they are mentioned.

In Chapter XXXIX. Section XVI., I had occaſion to ſpeak particularly of compound fractures: I ſhall at preſent therefore only remark, as the ſubſtance of what was then fully pointed out, that in the army and navy, where ordinary patients cannot be duly attended, and where they muſt be much jolted, and often removed from place to place, immediate amputation ſhould be adviſed in all caſes of bad compound fractures. Caſes will often indeed occur even in the worſt ſituations, in which it will be improper to amputate the limbs. Thus, where little violence has been done, and where the bones have been broken ſo much in a tranſverſe direction, that when replaced they ſupport each other with firmneſs, and eſpecially if one bone only is broken, it would no doubt be a ſevere, and often an unneceſſary meaſure, to propoſe the removal of the limb. But whenever much violence has been done to a limb; when the bones are broken in ſuch a manner that they do not, even when exactly replaced, ſupport each other firmly, and when the fleſhy parts that cover them are much torn; in all ſuch ſituations, I conſider it as a good general rule to adviſe immediate amputation. Unleſs the operation, however, can be performed ſoon after the accident, it cannot again be admiſſible for a conſiderable time; for whenever a limb has become ſwelled and inflamed, it can never, but with the utmoſt danger, be taken off till theſe ſymptoms ſubſide.

In private practice, however, where the patient can from the firſt be placed in an eaſy comfortable ſituation, from which he need not be removed till his cure is completed; where he can be kept perfectly quiet, and have all the advantages of good air, a proper regimen, and the aſſiſtance of able practitioners, very few caſes will occur in which immediate amputation ſhould be adviſed. The only cauſe, as I have elſewhere obſerved, which in ſuch circumſtances can render immediate amputation proper, is the bones of a limb, together with the muſcles and other ſoft parts with which it is covered, being ſo ſhattered and bruiſed that there will be no chance of the limb being rendered uſeful by any attempt that might be made to ſave it: In ſuch circumſtances, it ſhould be removed immediately; but this not being done, the operation, as I have obſerved above, ſhould be delayed, till the ſwelling, inflammation, and fever induced by the accident, are removed.

Although early amputation, however, is ſeldom neceſſary in private practice, yet, in the after-treatment of compound fractures, it is ſometimes proper:

1. In conſequence of profuſe hæmorrhagies which cannot be otherwiſe ſtopped. Theſe ſometimes happen from one or more arteries being cut by the ends of the fractured bones, as well as from other cauſes.

2. In conſequence of extenſive mortification. This we ſhall have occaſion to conſider more particularly in ſpeaking of mortification as one of the general cauſes of amputation.

And, 3. By the ends of the fractured bones remaining long diſunited, attended with the diſcharge of ſuch large quantities of matter, that the patient runs ſome riſk of ſinking under it.

I have elſewhere obſerved, that the union of fractured bones is ſometimes prevented by a looſe portion of bone being left which ought to have been removed; and nothing more readily keeps up a profuſe diſcharge of matter: But when all ſuch pieces of bone have been removed; when no union takes place; or when the diſcharge ſtill continues in ſuch quantities as to weaken the patient notwithſtanding of all that can be done to prevent it; ſuch as preſerving the limb ſteadily in one poſture, regular dreſſing of the ſore, a nouriſhing diet, and a plentiful uſe of bark; nothing will in ſuch circumſtances ſo certainly ſave the patient as the removal of his limb.

2. I mentioned extenſive laceration and contuſed wounds as the ſecond general cauſe of amputation. Wounds not accompanied with fractures of the contiguous bones are ſeldom ſo bad as to require amputation in any ſtage of them: But when a limb is ſo ſeverely lacerated or contuſed as to have all the large bloodveſſels that

belong to it deſtroyed, ſo as to leave no ground of hope that the circulation can be preſerved in it, immediate amputation ſhould be adviſed, whether the bone is ſafe or not. As in ſuch circumſtances no effort on the part of the practitioner could ſave the limb; and as wounds of this deſcription are more apt to terminate in mortification that any other, the ſooner the operation is performed the better.

It will alſo happen in lacerated and contuſed wounds, that amputation may be afterwards neceſſary, although it did not appear to be ſo at firſt. In this reſpect they are ſimilar to compound fractures, and the ſame obſervations will apply to them. Hemorrhagies may occur which cannot be ſtopped; extenſive mortification may take place; and ſuch large quantities of matter may form, that the patient will not be able to bear up under the diſcharge. In any of theſe events, we have to conſider the removal of the limb as the only remedy.

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3. The removal of a portion of a limb by a cannon-ball or other violence, was mentioned as the third general cauſe of amputation.

This is one of thoſe caſes which many contend can never require amputation: for the limb being already removed, it will be better, they allege, to endeavour to heal the ſore, than to add to the pain and danger of the patient by an operation. The argument is plauſible, but it will not bear examination.

In wounds of this kind, the bones are commonly much ſhattered, and even ſplintered; and the muſcles and tendons are left of unequal lengths, and much lacerated and contuſed. In this ſituation it is allowed by all, that the ſeparate pieces of bone, as well as the ſharp ends of the remaining bone, ſhould be removed, together with the ragged extremities of the muſcles and tendons. Now all this could ſeldom, I believe, be done in leſs time than the operation of amputation; while by amputating above the injured part, and covering the bone with ſound muſcles and ſkin, we diminiſh the ſore ſo much that it would probably heal in a third part of the time that the original wound would require; at the ſame time that the patient will have a good ſtump, which in the other method never could be the caſe: With me this laſt argument of itſelf would be ſufficient for adviſing the operation under the circumſtances we are conſidering: For, as I do not ſuppoſe it would add to the danger, any additional momentary pain it might occaſion, would be amply compenſated by the advantage he would afterwards derive from it. When the practitioner has it in his power, the operation ſhould be adviſed immediately; for, however neceſſary it might be, many patients would not afterwards have ſufficient firmneſs of mind to ſubmit to it; and, from ignorance of the advantages to be derived from it, would prefer preſent eaſe, to future conveniency and advantages, however great they might be.

4. Mortification is the next cauſe we have to conſider by which amputation may become neceſſary. They who are determined to oppoſe the practice of amputation as much as poſſible, affect to conſider it as unneceſſary even in mortification: all the leſſer degrees of it, they obſerve, may be cured; and when very extenſive, the patient, they allege, will commonly fall a ſacrifice to the diſeaſe, whether the operation is performed or not. This opinion, however, is ſo directly contrary to fact, and to the experience of every unprejudiced practitioner, that I need not attempt to refute it: For although it would be highly improper to adviſe the removal of a limb in ſlight degrees of gangrene; yet when mortification has ſpread ſo extenſively as to deſtroy all or even a great proportion of the ſoft parts of a limb, an occurrence too frequently met with, what remedy could be employed inſtead of it? As I know of none, and as I never heard of any that in any way could prove uſeful, I ſhall conclude, that

in mortification proceeding to ſuch an extent as I have mentioned, amputation of the limb becomes indiſpenſable.

But although this doctrine will be generally admitted, yet practitioners are not agreed with reſpect to the period of mortification at which the operation ſhould be performed. Some contend, that in almoſt every caſe of gangrene, and eſpecially where it proceeds from external violence, the limb ſhould be amputated as ſoon as mortification is evidently formed, and while it continues to ſpread: Others are of opinion, that amputation ſhould never be adviſed till the gangrene is not only ſtopped, but till the gangrenous parts are ſeparated from the ſound.

Thoſe who adviſe immediate amputation obſerve, that by taking the limb off above the diſeaſed part, we may prevent the progreſs of the mortification, and may thus ſave the patient. Although the argument is ſpecious, it does not appear to be well founded; and ſo far as my obſervation goes, I would ſay that it is a practice fraught with danger, and ought univerſally to be diſcarded: For however attentive we may be in amputating at a part of the limb that appears to be ſound, even the moſt experienced practitioner will be liable to be deceived. The ſkin may be perfectly ſound, and may be free from pain, inflammation, and ſwelling; and yet the deep-ſeated muſcles, and other parts contiguous to the bone, may be in a ſtate of gangrene. Of this I have ſeen various inſtances: But even where the whole divided parts are found to be entirely ſound, if the operation is performed while mortification is advancing, the diſeaſe ſeldom fails of ſeizing the ſtump; at leaſt, I never knew an inſtance of the contrary, and I have unfortunately been concerned in different caſes where this practice was adopted. On converſing with practitioners, who, from peculiarity of ſituation, have much employment in thoſe accidents which are moſt apt to terminate in gangrene, I alſo find that their experience tends to ſupport this opinion: It was alſo the decided opinion of the late Mr Sharpe, and Mr Pott, and of every modern practitioner of obſervation *. I think it right to mention this, as attempts have of late years been made by ſome ſpeculative practitioners to introduce a contrary practice; which if admitted, there is much reaſon to ſuſpect would prove extremely hurtful, although from its proving ſo univerſally unſucceſsful, there is reaſon to hope that it will ſoon be laid aſide, even by thoſe who at preſent patronize it.

I would not think it neceſſary, however, to delay the operation ſo long as is adviſed by ſome, and particularly by Mr Sharpe; who thinks that it ſhould never be performed till the ſeparation of the mortified parts is conſiderably advanced.

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* Mr Pott's words upon this point are very ſtrong: "I have more than once ſeen the experiment made of "amputating after a gangrene has been begun; but I "never ſaw it ſucceed:—It has always hurried the pa- "tient's deſtruction."—Vide Remarks on Fractures, &c.

ced *. As Mr Sharpe was a man of much experience, his obſervation may prove to be well founded; but ſo far as I have yet ſeen, I would conſider it as ſufficient to wait till the mortification is completely ſtopped, but not much longer: In this manner, we ſeem to reap all the advantages which the caution that I have adviſed can give; and the earlier after this that the mortified parts are removed, the more readily we prevent the ſyſtem from ſuffering by the abſorption of that putreſcent matter which a gangrenous maſs univerſally yields.

The opinion that I have given relates to every variety of gangrene. In whatever way it may have ariſen, the practice ſhould be the ſame: For although ſome ſtreſs has been commonly laid upon the circumſtance of its proceeding from an internal or external cauſe, yet no utility is derived from this. The operation ſhould in no inſtance be adviſed till the period I have

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* Vide Treatiſe on the Operations of Surgery, Chapter xxxvii.

have mentioned; and at that time, whatever may have been the cauſe of the diſeaſe, no delay ſhould be admitted.

5. In mentioning white-ſwellings of the joints as a cauſe of amputation, I muſt refer to Chapter II. Section III. § 10., for the management of the diſeaſe, as well as for a more particular account of thoſe ſymptoms that more eſpecially indicate the operation. At preſent I have only to obſerve, that as long as there is the leaſt reaſon to hope that by any means the limb may be ſaved without hazard to the patient, the operation ſhould never be adviſed. As a farther motive for this, I may remark, in addition to what I have in various parts of this work done already, that amputation, more frequently ſucceeds, that is, a greater proportion recover from the operation when it is delayed till the patient is conſiderably reduced by the diſeaſe, than when it is performed in the more early part of it. The cauſe of this may be nearly the ſame as what I have given in Chapter XXXIX., Section XVI.,

when adviſing late Amputation in ſome circumſtances of Compound Fractures.

6. In Chap. II. Sect. III., I entered upon the conſideration of the various kinds of exoſtoſis; ſo that at preſent I have only to remark, that when a diſeaſed portion of bone cannot be taken out in the manner I have formerly adviſed, and when the tumor is either hurting the patient's health or has become unſupportable from its ſize or any other circumſtance, amputation of the limb, when no particular reaſon prevents it, ſhould be adviſed as the only remedy.

7. The next cauſe that I haye mentioned of amputation, is an extenſive caries attended with ulcers of the contiguous parts. When ſpeaking of caries, in the ſeventh Section of Chapter V., I pointed out the different means employed for the cure of the diſeaſe, that is, for promoting an exfoliation of the diſeaſed part of the bone. In addition to what I had then occaſion to ſay, it may be obſerved, that although an extenſive caries is in general conſidered

of itſelf as a ſufficient reaſon for amputating a limb, yet it certainly ſhould be admitted under much reſtriction. However extenſive a caries may be, even although it occupies the whole length of a bone, it may be in many inſtances removed; and we have many on record of deficiencies produced in this manner being amply ſupplied by a regeneration of bone: So that where the conſtitution is ſound, and more eſpecially when the patient is young, a carious bone will ſeldom of itſelf be a ſufficient motive for removing a limb, at leaſt the chance of ſaving it by removing the diſeaſed bone ſhould firſt be given. But when a carious bone is conjoined with deep and extenſive ulcers of the correſponding ſoft parts, which might give much cauſe to ſuſpect that a cure would not be obtained even although the diſeaſed bone ſhould be taken out, amputation ſhould be preferred; for in this ſituation, beſides the difficulty of healing the ſores, the formation of any conſiderable quantity of bone would be very uncertain, and therefore the riſk ſhould not be incurred.

8. The next cauſe to which we have to advert, by which amputation may become neceſſary, is cancer, and other ulcers of an inveterate nature.

When ſpeaking of Cancer in Chapter V. Section VIII., I endeavoured to ſhow, that no dependence is to be placed either upon internal medicines or outward applications for a cure; and that the removal of the diſeaſed part is alone to be truſted. It muſt be acknowledged that cancer does not frequently occur in the extremities: But every practitioner muſt have ſeen it on different parts of them; and wherever it appears, the removal of the diſeaſed parts with the knife ſhould be adviſed immediately. They may be often taken away without amputating the limb; but when the diſeaſe has attacked the ligaments or bones, and eſpecially when the ſore is extenſive, nothing but the removal of the limb above the parts diſeaſed ought to be truſted. In ſuch circumſtances, I have known attempts made to ſave the limb, but never with ſucceſs. Even the removal of the limb will ſometimes fail; but I have known it anſwer where the diſeaſe had returned after being removed in the uſual way.

Beſides cancer, other ulcers may, in particular circumſtances, render amputation neceſſary: Where an extenſive ulcer, not induced by any general affection of the ſyſtem, is hurting the health of a patient; and when, inſtead of yielding to the uſual remedies, it becomes more extenſive and more inveterate, as it might at laſt proceed ſo far as to endanger life, we ought rather to adviſe the limb to be taken off. Such ulcers as are uſually termed Phagadenic, ſometimes terminate in this fatal manner: But this termination is moſt frequent in ſinuous ulcers; ſuch as ariſe from deep-ſeated abſceſſes, where the matter has found acceſs between the interſtices of the large muſcles, and where, notwithſtanding all our endeavours, the diſcharge continues to be ſo profuſe as to endanger the life of the patient.

9. Various kinds of tumors may render amputation neceſſary.

Encyſted tumors ſeldom lead to this neceſſity; but in ſome inſtances where they are deep-ſeated, originating perhaps from the perioſteum, when they are allowed to remain till they acquire a great bulk, all the contiguous parts come to be ſo much injured, that nothing but the removal of the limb will anſwer any good purpoſe. In ſome caſes, by long-continued preſſure from the tumor, the contiguous bones not only become carious, but are altogether diſſolved; at the ſame time that the cellular ſubſtance, and even the muſcles of the limb, become ſo much diſeaſed as to give no cauſe to hope that we could be able to ſave them.

We ſometimes find a portion of a limb conſiderably enlarged, with an uniform hardneſs in ſome parts, and in others a degree of ſoftneſs that gives cauſe to ſuſpect that a fluid is collected beneath. The ſkin at firſt retains its natural colour; but at laſt acquires a livid hue. The commencement of the diſeaſe is not attended with pain; but at laſt it not only becomes painful, but extremely troubleſome from its weight. It uſually begins without any evident cauſe, and often in people who are otherwiſe healthy: At firſt the ſwelling commonly appears on the inferior part of a limb, and proceeds gradually up till it occupies the whole of it.

This kind of ſwelling is at firſt often miſtaken for common œdema or anaſarca; and ſeems to be ſo far of this nature, that it is evidently produced by effuſion into the cellular ſubſtance: But inſtead of being of the ſerous kind, the effuſed fluid is found to be tinged with blood, and of an acrimonious nature; at leaſt this has been the caſe in all that I have known opened: And it has likewiſe happened, that the matter has never been diſcharged in ſuch quantities as to have much influence on the ſize of the tumor, the ſwelling uſually remaining of nearly the ſame bulk after the operation as it was before: Hence no advantage is derived from it; on the contrary, the operation very commonly does harm. A painful ſore is produced; and it always accelerates the progreſs of the tumor. Indeed, nothing that I have ever known employed has any effect in retarding it; ſo that I conſider amputation as the only reſource, whenever the tumor has become ſo large as to give much uneaſineſs. Whether it will always prove effectual or not, I cannot pretend to ſay; but hitherto I have met with no inſtance of the diſeaſe returning where amputation was performed on a ſound part of the limb.

Swellings of the aneuriſmal kind have alſo been conſidered as a cauſe which, in particular ſituations, may give riſe to amputation. This has originated from the operation for the aneuriſm having failed in different inſtances when performed upon the crural artery, and from the amputation of the limb having in ſimilar affections ſaved the life of the patient.

When an aneuriſm in the ham, or the thigh, is large, and has been of ſuch long duration as to hurt the texture of the ſoft parts, as well as to injure the bone, which effuſed blood is apt to do, it will no doubt be better to amputate the limb than to make any attempt to ſave it: But in ſuch a caſe, it is not the aneuriſm for which amputation is adviſed, but a morbid ſtate of the parts, induced by the diſeaſe being allowed to continue too long before any effectual meaſure is adopted. In the commencement, and for a conſiderable time thereafter, of the femoral or popliteal aneuriſm, I ſhould never adviſe the amputation of a limb: For different inſtances are on record of limbs being ſaved by the operation for the aneuriſm, even where the artery was injured in the ſuperior part of the thigh: But where ſuch an extenſive œdematous ſwelling is induced all over the under part of a limb, as to leave no room to hope that it could again be reſtored to uſe, even allowing the operation for the aneuriſm to ſucceed, it will no doubt be better to amputate immediately than to attempt the operation.

The aneuriſm to which I allude, is that which proceeds from a dilatation of the artery, and in which the coats of the veſſel have burſt, ſo as to produce a conſiderable effuſion of blood into the ſurrounding cellular ſubſtance, probably before any proper aſſiſtance is deſired. This will ſeldom happen but with the pooreſt claſs of people; and therefore this diſeaſe, in the ſtate we are now ſpeaking of, is chiefly found in hoſpitals. At firſt it is always attended with a ſtrong pulſation; but in its later ſtages the ſwelling becomes ſo large, that the beating of the artery is ſcarcely, if at all diſcovered; by which it is apt to be miſtaken for a tumor of a different kind: But for the moſt part, a due attention to the hiſtory of the caſe from the beginning, will lead to a knowledge of its real nature.

The 10th general cauſe that I enumerated, by which amputation may become neceſſary, is particular diſtortions of a limb.

Where a limb is in other reſpects perfectly ſound, it will ſeldom happen that any diſtortion to which it is liable will be conſidered as a ſufficient reaſon for this operation: But in the courſe of much buſineſs, caſes are ſometimes met with in which limbs are ſo much diſtorted, and produce ſo much diſtreſs, that patients rather incline to have them removed than ſubmit longer to the inconvenience. When in ſuch circumſtances we are not able to remove the diſtortion by means of a more gentle nature, we are in ſome caſes obliged to comply with the patient's requeſt.

11. Certain ſtates of necroſis may render amputation neceſſary, as may be ſeen in Chapter XLIII.

Theſe are the ſeveral cauſes by which the amputation of a limb may be rendered neceſſary. As they are very various, and as the loſs of a member is to every patient an object of much importance, they merit, in every inſtance, the utmoſt attention from practitioners. Indeed this point of practice, namely, that of fixing with preciſion thoſe caſes in which the amputation of limbs ſhould be adviſed, with the moſt ſuitable periods for the operation in each, is attended with ſuch difficulty, and a ſurgeon is ſo apt to be blamed if he proceeds to the operation ſo long as there is the ſmalleſt doubt of its being neceſſary, that it ſhould be held as a fixed regulation with every practitioner, never to operate but with the advice of ſome of his brethren in conſultation, when this can poſſibly be obtained. I ſhall now proceed to deſcribe the method of operating.

SECTION III.

General Remarks on the Method of Amputating Limbs.

SURGERY is not perhaps in any part of it brought to greater perfection than in the method of amputating limbs. Before the invention of the tourniquet, this operation was attended with ſo much hazard, that few ſurgeons ventured to perform it: Nay, long after the introduction of this inſtrument, the danger attending it was ſo great, that more than one half periſhed of all who had reſolution to ſubmit to it.

In the preſent improved ſtate of the operation, I do not imagine that one death will happen in twenty caſes; even including the general run of hoſpital practice: And in private practice, where due attention can be more certainly beſtowed upon the various circumſtances of the operation, the proportion of deaths will be much leſs.

The circumſtances in this operation that more particularly require attention, are, the choice, when this is in our power, of the part at which a limb ſhould be amputated; the prevention of hemorrhagy during the operation; the diviſion of the ſkin, muſcles, and bones, in ſuch a manner as to admit of the ſtump being completely covered; the tying of the arteries alone, without including the nerve or any of the contiguous parts; ſecuring the teguments in a proper ſituation, ſo as to prevent their retraction after the operation; and a proper ſubſequent treatment of the caſe.

Next to ſecuring the patient from loſs of blood, the moſt material of theſe is the ſaving of ſuch a proportion of the ſoft parts as will cover the ſtump, ſo as to heal the ſore as nearly as poſſible by the firſt intention: For without this, the wound produced by the removal of a large limb is always extenſive; the cure accordingly proves tedious; and the diſcharge ſo copious, that the patient's health is by this cauſe alone irreparably injured.

The inconveniencies ariſing from this were ſo obvious, that various attempts were made, from time to time, to improve this part of the operation. At firſt, all that was done in amputating a limb, was to cut the ſoft parts down to the bone by one ſtroke of a knife, and afterwards dividing the bone with the ſaw at the edge of the retracted muſcles. It was afterwards propoſed by Mr Cheſelden to divide the ſoft parts by a double inciſion; to divide the ſkin and cellular ſubſtance with a circular inciſion; and then to cut through the muſcles at the edge of the retracted ſkin: By this means the ſaw was applied higher in the bone, and the ſtump was better covered both with muſcles and ſkin. Still, however, an extenſive ſore was left; inſomuch that in amputating the thigh, a cure was ſeldom performed in leſs than three or four months; often five or ſix were required; and after all, the ſtumps were commonly pyramidal, by the bone projecting beyond the ſoft parts: It often happened too, that another ſore was produced by this part of the bone exfoliating, long after the patient conſidered himſelf as perfectly well.

To prevent this Pyramidal or Sugar-loaf Stump, as it is termed, a bandage or circular roller was employed, with a view to ſupport the muſcles and teguments, and to prevent their retraction; and when properly applied from the upper part of the limb downwards, it in ſome degree anſwered the purpoſe, but never with ſuch effect as to prevent the cure from being tedious. In order to ſhorten it farther, it was propoſed by the late Mr Sharpe, in his Treatiſe on this Operation, to draw the teguments near together by ſtitches or pieces of tape paſſed through them, and tied acroſs the ſtump: But the pain and inconvenience ariſing from this was ſo great, that it never was generally practiſed; and Mr Sharpe himſelf at laſt deſiſted from it.

It was now thought impoſſible to improve this method of operating, ſo as to ſhorten the cure, and in place of a pyramidal ſtump, to give the ſore a plain ſurface. In conſequence of this, about forty years ago, different ſurgeons attempted to revive what was termed the flap operation; which had been firſt practiſed, upwards of a hundred years ago, by an Engliſh ſurgeon of the name of Loudham. It was done by ſaving a flap of the muſcles and ſkin, in the manner I ſhall afterwards deſcribe, laying the flap over the ſtump, and ſecuring it in this ſituation with proper bandages till it united to the parts beneath.

As this afforded a thick muſcular cuſhion to the ſtump as well as a complete covering of ſound ſkin, the higheſt expectations were formed of it: But the objections to it, which I ſhall afterwards mention, were ſo great, that the utmoſt exertions, even of expert ſurgeons, to render it more perfect, have not been able to introduce it to general uſe.

This failure again excited the attention of practitioners to the improvement of the common operation of amputation; and their endeavours have not proved unſucceſsful. By the preſent improved method of operating, ſo much of the teguments are ſaved as completely covers the ſtump; by which, in ſome inſtances, a cure is obtained by the firſt intention without the formation of matter: And in all, unleſs there is ſomething particularly bad in the habit of body, or unleſs the inflammation unexpectedly runs to a very unuſual height, a cure is completed in the courſe of a few weeks. As I conſider the improvement by which theſe ends are effected as one of the moſt important in modern practice, I hope to be excuſed, if I ſhortly ſtate the ſhare I have had in the introduction of it, before proceeding to deſcribe the operation itſelf.

In the courſe of my education, while attending the hoſpital here, as well as the hoſpitals of London and Paris, the inconveniencies ariſing from the want of attention to the ſaving of ſkin in different chirurgical operations, ſtruck me ſtrongly; ſo that I was reſolved to take every proper opportunity in my own practice, of treating this point with particular attention.

From the year 1772, when I ſettled in buſineſs, I laid it down as a maxim, not to be deviated from, to ſave as much ſkin and cellular ſubſtance in the removal of tumors, whether cancers or others, when the ſoundneſs of parts admitted of it, as would completely cover the ſores; and in amputating any of the extremities to ſave as much of them as would entirely cover the ſtumps. I firſt performed amputation in the courſe of that year; and finding the improvement of ſaving ſkin to anſwer even beyond my expectation, (for the cure of a large ſtump in an amputation of the thigh was completed in three weeks), I did not fail of putting it afterwards in practice both in public and private. The practice was likewiſe adopted by my friend Mr Hay of this place, and more lately by ſome other gentlemen in their attendance at the hoſpital; and ever ſince that period, Mr Hay, I believe, and I, have invariably adhered to it, ſome deviations being occaſionally introduced in the mode of doing it, with a view of rendering it more perfect; by which the cures have in every inſtance been greatly ſhortened. In various caſes, large ſtumps which by the uſual method would have required ſeveral months, were cured in as many weeks: In a few, as was obſerved above, the parts united by the firſt intention; and in all, a plain uniform ſtump was produced.

After this had been practiſed for ſeveral years, Mr Alanſon of Liverpool, in the year 1779, publiſhed ſome Obſervations upon Amputation, in which a method of operating is deſcribed, which he recommends in the warmeſt manner, as anſwering every object to be expected from this operation; and more eſpecially, that of curing the ſtumps in a great meaſure by the firſt intention.

As Mr Alanſon's mode of operating has of late been very deſervedly preferred to every other that was before publiſhed, I ſhall afterwards give an account of it; but in the mean time, I ſhall deſcribe that which I have long been accuſtomed to practiſe, and which, after various trials of every other of which I have yet heard, I ſtill continue to prefer. In the firſt place, I ſhall deſcribe the operation as it is performed upon the thigh, and ſhall afterwards ſpeak of the method of amputating other parts of the extremities.

SECTION IV.

Of Amputating the Thigh.

IN amputating either the thigh or leg, the patient ſhould be placed upon a table of an ordinary height, with the leg properly ſecured and ſupported by an aſſiſtant ſitting before him. The other leg ſhould likewiſe be ſupported, at the ſame time that the arms ſhould be ſecured by an aſſiſtant on each ſide, to prevent interruptions during the operation.

The flow of blood to the limb ſhould now be ſtopped by the application of the tourniquet, in the manner I have mentioned in Chapter VII.: And as it is of importance to have the inſtrument placed as near as poſſible to the top of the thigh, the cuſhion placed upon the femoral artery ſhould reach the groin.

This is neceſſary when the operation is to be performed on the upper part of the limb; but it may likewiſe be done with ſafety where it is to be taken off immediately above the knee: And I may here obſerve, with reſpect to the moſt proper place at which a thigh ſhould be amputated, that no more of it ſhould be taken away than is rendered neceſſary by the diſeaſe; for the more of it that is left, the more uſeful it proves.

An aſſiſtant ſhould now be directed to graſp the upper part of the limb with both hands, and to draw up the ſkin and cellular ſubſtance as far as poſſible. While the parts are in this ſtate of tenſion, the operator, ſtanding on the outſide of the patient, ſhould divide them with a circular inciſion down to the muſcles: This may in general be done with one ſtroke of the amputating knife, fig. 3. Plate XCVII.; but in large limbs it is eaſier done at twice. The aſſiſtant continuing to draw the teguments upwards, the cellular ſubſtance connecting them to the muſcles beneath, ſhould be divided with the edge of the knife till as much of the ſkin is ſeparated as the operator thinks will completely cover the ſtump.

The ſkin being ſtill drawn tightly upwards, the muſcles ſhould be divided cloſe to the edge of it down to the bone, by one perpendicular and continued ſtroke of the knife, beginning with the upper part of the large muſcles on the inſide of the thigh, and continuing the inciſion round through thoſe beneath, and on the outſide till it terminates where it commenced. During this part of the operation, ſome attention is neceſſary to avoid the edge of the retracted ſkin; but it may always be done if the operator is upon his guard, for he may with little difficulty have his eye upon the courſe of the knife from firſt to laſt; nor can this part of the operation be done with ſafety in any other manner. Even where different aſſiſtants are employed to protect the ſkin, it will be apt to be wounded, if the operator does not at every point follow the knife with his eye.

In the uſual method of operating, the bone would now be ſawn acroſs at the edge of the retracted muſcles: But we are more certain of having a good ſtump, if the muſcles are previouſly ſeparated from the bone for the ſpace of an inch; and it is eaſily done by inſerting the point of the amputating knife between them, and carrying it freely round from one ſide of the limb to the other. This being done, the muſcles and teguments muſt be drawn up as far as the muſcles have been ſeparated from the bone; and it is eaſily done, either with a bit of ſlit leather, ſuch as is repreſented in Plate XCVIII. fig. 4. or with the iron retractors in the ſame Plate, fig. 2. and 3. The perioſteum ſhould now be divided at the place where the ſaw is to be applied, and it ſhould be done with one turn of the knife; for where much of it is ſcraped off, very tedious and troubleſome exfoliations are apt to enſue: The knife ſhould therefore be carried round the bone directly beneath the retractors. At this place the ſaw ſhould be applied, and with long ſteady ſtrokes the bone ſhould be divided. The ſaw repreſented in Plate XCVII. fig. 1., anſwers much better than the uſual form of the inſtrument with a heavy iron back. In performing this part of the operation, the aſſiſtant holding the leg ſhould be directed to ſupport it ſteadily; for if raiſed too far, the motion of the ſaw will be impeded, while the bone will be apt to be ſplintered if it be not ſufficiently raiſed. Any points or ſplinters that may be left, ſhould be immediately removed with the nippers, Plate XLIII. fig. 2.

The retractors ſhould now be taken off; and the trunk of the femoral artery being eaſily ſeen, ſhould be drawn out with a tenaculum, and a ſufficient ligature made upon it before the tourniquet is looſened: But as the muſcular branches of this artery cannot be diſcovered as long as they are compreſſed, the ſcrew ſhould be immediately untwiſted, ſo that the preſſure may be entirely removed. All the clotted blood ſhould be now removed from the ſtump with a ſoft ſponge ſoaked in warm water; and every artery that can be diſcovered ſhould be ſecured with a ligature, care being taken to leave the ends of the threads of a ſufficient length to hang over the lips of the wound.

The bloodveſſels being all ſecured, and the ſurface of the wound cleared of blood, the muſcles and teguments ſhould be drawn down till the ſkin completely covers the ſtump, and ſhould be retained in this ſituation by an aſſiſtant till a flannel or cotton roller, previouſly fixed round the body to prevent it from ſlipping down, is applied in ſuch a manner as to ſupport and fix them: For which purpoſe the roller ſhould be paſſed two or three times, nearly in a circular direction, round the top of the thigh; and ſhould afterwards, with ſpiral turns, be brought down near to the end of the ſtump, of ſuch a tightneſs as to prevent the muſcles and ſkin from retracting, without compreſſing them ſo much as to prove painful, or to impede the circulation. Here the roller ſhould be ſixed with a common pin, while as much of it is left as will paſs two or three times round the ſtump, for a purpoſe to be preſently mentioned.

The ends of the divided muſcles being placed with as much equality as poſſible over the bone, the edges of the ſkin muſt be laid exactly together, ſo as to form a ſtraight longitudinal line along the centre of the ſtump. When only one or two arteries have been ſecured, the ligatures ſhould be left out at the inferior angle of the wound; but when there are ſeveral, they ſhould be divided between the two angles, to prevent the parts from ſuffering by a large extraneous body fixed at any one place.

While an aſſiſtant retains the edges of the divided ſkin in contact, two or three ſlips of adheſive plaſter ſhould be laid acroſs the face of the ſtump, to preſerve them in this ſituation; and the whole ſurface of the ſtump ſhould now be covered with a large pledget of ſoft lint, ſpread with ſaturnine cerate, or the common calamine cerate of the Diſpenſatories: Over this there ſhould be placed a ſoft cuſhion of fine tow with a compreſs of old linen. For the purpoſe of retaining them, as well as with the view of making gentle preſſure upon the ſtump, a ſlip of linen, of three inches in breadth, ſhould be laid over them; ſo as to paſs directly acroſs, and not from above downwards. On being properly placed, the remaining part of the roller ſhould be employed to fix it, by paſſing it two or three times round the ſtump; and the preſſure formed by the croſs ſtrap may afterwards be increaſed or diminiſhed, by drawing it with more or leſs tightneſs, and fixing it with pins to the circular roller.

In applying the roller, the tourniquet ſhould be removed, and replaced immediately when the ſtump is dreſſed. If left looſe, it gives no uneaſineſs; and it enables the attendants to check any hemorrhagy that may take place; a circumſtance that merits attention for ſeveral days after amputation of any of the extremities.

The patient ſhould now be carried to bed; but inſtead of raiſing the ſtump to a conſiderable height with pillows, as is uſually done, it ſhould be laid ſomewhat lower than the reſt of the body: For this purpoſe, the bed ſhould be previouſly made with a gentle declivity from above downwards, and nothing ſhould be put beneath the ſtump but fine tow.

To prevent the patient from moving the limb inadvertently, as well as to guard in ſome meaſure againſt the effect of thoſe ſpaſms which often prove troubleſome after this operation, I commonly employ two ſlips of flannel to fix the ſtump down to the bed. It is eaſily done, by laying one acroſs near the extremity of the ſtump, and another near to the root of the thigh. They ſhould be pinned to the circular roller round the limb; and the ends of each of them ſhould be pinned to the bed: Or they may be tied to it with pieces of ſmall tape previouſly ſewed to the bed, or to the mattreſs, which anſwers better than a feather-bed for any patient to be long confined.

fined. A baſket or hooped frame ſhould now be put over the ſtump, to protect it from the bed-clothes; and whether the patient complains much or not, I make it a conſtant rule to give him an anodyne, by which he remains quiet and eaſy through the remainder of the day, inſtead of being reſtleſs and diſtreſſed, which he is otherwiſe apt to be.

As hemorrhagies will ſometimes happen, even many hours after the operation, the attendant taking charge of the patient ſhould be ſtrictly enjoined to examine the ſtump frequently with the utmoſt care; and on any quantity of blood breaking out, to twiſt the tourniquet ſufficiently tight, till aſſiſtance is procured. I think it right, however, to obſerve, that in general it is the fault of the practitioner when this very perplexing occurrence takes place; for it ſeldom happens when the arteries are ſearched for in the time of the operation with that accuracy which the importance of the ſituation requires. Indeed, hemorrhagies are leſs frequent after this method of operating, than when the muſcles are left uncovered; and this is one material advantage that reſults from it: For however attentive a ſurgeon may be in ſecuring the arteries, the irritation produced upon an extenſive wound, and the ſpaſms that enſue, very frequently terminate in fatal hemorrhagies. Of this I have known ſeveral inſtances; while no diſcharge of any importance has ever happened in the method of operating, of which I have thus given a deſcription. I believe too, as I have elſewhere remarked, that ſome additional ſecurity is derived from the uſe of the tenaculum: For although thoſe who have not been in the habit of uſing it, are apt to conſider it as more uncertain than the needle, yet it is far from being ſo. I will not ſay that hemorrhagies will never enſue where the tenaculum is employed; but it has ſo happened in the courſe of my obſervation, that the needle was uſed in every caſe of hemorrhagy that proved fatal.

Where there is only a trivial oozing of blood, we need not be alarmed; nor will it be neceſſary to remove the dreſſings: But whenever the diſcharge is ſo conſiderable as to give cauſe to ſuſpect that it proceeds from a large artery, nothing but ſecuring it with a ligature can be depended on. This being done, the dreſſings muſt be renewed in the ſame manner as at firſt.

The only other ſymptoms that we have reaſon to dread, during the firſt three or four days after the operation, are ſevere ſpaſmodic affections of the muſcles, and inflammation and tenſion of the ſtump, with the conſequent fever which in ſome degree ſucceeds to every caſe of amputation, but which always proves hazardous when it proceeds to a great height.

When the arteries are tied without including the nerves or any part of the contiguous muſcles, theſe ſpaſms ſeldom become troubleſome: But when they take place, if laying the limb in an eaſy relaxed ſtate does not render them moderate, we truſt chiefly to opiates for their removal.

With a view to prevent inflammation, the patient ſhould be confined to as low a regimen as the ſtate of his ſtrength will permit. In weak emaciated habits, this muſt be managed with much diſcretion, as the conſtitution might be materially hurt by a low diet: But where there is much plethora, with tenſe fibres, together with a ſtrict antiphlogiſtic regimen, the patient ſhould be blooded as ſoon as quickneſs and fulneſs of pulſe or other ſymptoms of fever take place: He ſhould take plentifully of diluent drink; and his bowels ſhould be kept open with any of the cooling neutral ſalts.

It is proper, however, to obſerve, that it is only during the firſt days after the operation that remedies of this kind are in general neceſſary. When the inflammatory ſtage is over, evacuations of every kind are to be dreaded; even laxatives are apt to do harm if carried farther than is juſt neceſſary for preſerving a regular ſtate of the bowels.

At the end of the ſecond day, whatever the previous ſymptoms may have been, the ſtump ſhould be examined. Where a free ſuppuration is expected, as always happens when the ſtump is not covered with ſkin, the parts ſhould not be looked at till the third or fourth day: But here there is no reaſon for this delay; and the patient is always made more eaſy and comfortable by the removal of the firſt dreſſings. For this purpoſe, the ſtump ſhould be gently ſupported by an aſſiſtant, till the laſt turns of the roller are undone, and till the croſs ſlips, tow, and even the large pledget of ointment next the ſore, are removed. In a few caſes the parts are found united by the firſt intention; but for the moſt part it is otherwiſe: There is commonly a ſmall quantity of matter over the ſurface of the ſtump, chiefly at the inferior angle of the wound; and the parts are red, tenſe, and painful to the touch, with a ſmall ſeparation or opening between the edges of the divided ſkin, notwithſtanding the plaſters employed to retain them. As in this ſtate the plaſters do no ſervice, they ſhould likewiſe be removed; and it is eaſily done when they are thus moiſtened with matter. The ſurface of the ſtump ſhould now be covered with a pledget of the ſame ointment as at firſt; and a cuſhion of ſoft tow being laid over it, the croſs ſlips of linen and the circular roller ſhould be again employed; but with no more preſſure than is merely neceſſary for ſupporting them.

In this manner the dreſſings ſhould be renewed daily; when, by the ſeventh or eighth day, the inflammation and tenſion will in general be ſo far diminiſhed as to admit of the ligatures on the arteries being eaſily removed; at leaſt they may now be gently pulled daily, and for the moſt part they yield on the ſecond or third trial: When allowed to remain longer, they not only prevent the wound from healing, but are apt to be more difficult to remove afterwards.

As long as the roller is preſerved clean, it may be allowed to remain; but as ſoon as it becomes ſullied with matter, it ſhould be removed and another applied in its place; nor ſhould it be entirely laid aſide till the third or fourth week from the operation. After this period, however, it ſhould be removed, as when longer continued it renders the limb ſmaller than the other.

As ſoon as the ſore is obſerved to be perfectly clean, with granulations ſprouting in different parts of it, as the pain and tenſion will now be quite removed, we may with ſafety venture to complete the cure, by drawing the edges of the wound together with adheſive plaſters. In this ſtate of the ſore no harm ever enſues from it, and it ſhortens the cure conſiderably.

By this management, even the largeſt ſtumps will for the moſt part be healed in three or four weeks; often in leſs. But it muſt be remarked, that although we may in general depend on this in private practice, where every circumſtance that can conduce to the welfare of the patient will meet with attention, and where eſpecially we may always obtain a well-ventilated apartment and proper diet; yet in public hoſpitals, where theſe points are not duly attended to, and where the patient often ſuffers more from the bad air that he breathes, than from the operation itſelf, our ſucceſs will not in every caſe be ſo great. Inſtead of the teguments adhering to the parts beneath, large quantities of matter ſometimes form between them, which always renders the cure more tedious, and which in ſome caſes cannot be accompliſhed but by ſending the patient to a more free air, and by a more plentiful allowance of wine and other cordials than can in general be obtained in hoſpitals. But for one inſtance of this, in the operation that I have deſcribed, I may with ſafety affirm, that twenty occur in the uſual mode of conducting it.

When ſpeaking of the time in which ſtumps may be expected to heal, I think it right to obſerve, that it ſhould not be our object to heal the parts in the firſt inſtance witthout the formation of matter: It commonly anſwers better when done in the more gradual manner I have pointed out. When a ſtump heals ſuddenly, and the edges of the divided ſkin adhere by the firſt intention, the teguments are apt to be puckered and uneven, and the ligatures of the arteries are removed with difficulty. Of this I have had different caſes, when ſuch ſtrong adheſive plaſters were employed, as kept the edges of the ſkin in cloſe contact: But when the common court-plaſter is made uſe of, or any other compoſition poſſeſſed of the ſame degree of adheſive property, although the teguments will be prevented from ſeparating to any conſiderable extent, yet they will readily yield to the retraction that uſually takes place on the acceſſion of tenſion and. pain. In this manner, a ſlight ſeparation is uſually produced; by means of which the ligatures are eaſily taken out; any matter that may form is readily diſcharged; the corners left above and beneath by the teguments being drawn together, are much leſſened; and the ſtump is always left ſmooth and equal: Hence thoſe ſtumps which take three weeks or perhaps a month to heal, are uſually of a better form than thoſe that heal much ſooner.

The advantages attending a ſpeedy cure, and covering the ſtump with ſkin, are ſo great, that they need not be enumerated; but I thought it right to mention the inconveniencies that occur from the union of the divided ſkin being too quickly connected, either with adheſive plaſters, or ſutures, which laſt have in ſome caſes been employed.

It will be readily perceived, that the principal difference between this operation and the uſual method of amputating, conſiſts in the ſaving as much of the muſcular ſubſtance of the limb as will completely cover the bone, together with as much ſkin as will cover the whole ſurface of the ſtump: But it is proper to remark, that we may err in ſaving more of each of theſe parts than is requiſite, and that ſome attention is therefore neceſſary to guard againſt it. In leaving too much muſcular ſubſtance, we muſt neceſſarily ſhorten the limb too much, by ſawing the bone higher than we otherwiſe would do; and by ſaving too much ſkin, we render the ſurface of the ſtump puckered and uneven.

With reſpect to the quantity of muſcular ſubſtance that ſhould be ſaved, I have hitherto found, that the directions given above, in general anſwer the purpoſe. By ſeparating the muſcles from the bone for the ſpace of an inch, and ſawing it at this height above where it is divided in the ordinary method of amputating, the bone will always be ſufficiently covered with fleſh; and a very little experience enables us to judge of the quantity of ſkin that ſhould be ſaved for covering the ſtump: But even when more is ſaved than is neceſſary for this purpoſe, a little attention will enable us to prevent inequalities. By an aſſiſtant drawing down the teguments, in the manner I have directed, before the roller is applied, as much of them may be pulled down as is juſt neceſſary; and if they are kept in this ſituation till the application of the roller is finiſhed, any inconveniency which might have enſued from too great a quantity will be prevented.

It will likewiſe be obſerved, that in making the firſt inciſion of the teguments, I have not deſired a circular piece of tape to be made uſe of, as is uſually done, to ſerve as a direction for the knife. This deviation from the common practice has been long adopted by ſome individuals; but ſo far as I know, it was firſt ſuggeſted by the late Dr Hunter of London; and I think it a material improvement of this part of the operation: For beſides the ſaving of time, which is always of importance in that ſtate of anxiety to which a patient is reduced who is placed upon a table for the purpoſe of loſing a limb, it in reality puts it in our power to make the inciſion with more neatneſs, more ſpeedily, and with leſs embaraſſment, than when the tape is employed.

ed. Thoſe who have been accuſtomed to uſe the tape will at firſt be of a different opinion; but whoever lays it aſide, will find, that the circular inciſion may be made with more exactneſs merely by following the knife with the eye; and I am certain that it may be done in one-half of the time. When the tape is employed, a good deal of time is loſt in endeavouring to keep the knife exactly in a line with the edge of it; and if not applied with the utmoſt exactneſs, it neceſſarily makes the inciſion ragged and unequal; an occurrence I have obſerved in different inſtances, even with expert ſurgeons, while I never perceived any inequality where the tape was not made uſe of.

It has been objected to the operation that I have deſcribed, that being more tedious than the uſual method of amputating, it muſt neceſſarily create more pain. The difference in this reſpect, however, is trifling; for it muſt be remembered, that the inciſion of the ſkin, and this is the moſt painful part in every operation, is the ſame in both. The diviſion of the cellular ſubſtance is quickly performed, and little or no pain enſues from it; and the third inciſion, if we may ſo term it, or the ſeparation of the muſcles from the bone, may be performed in the tenth part of a minute. In different inſtances, I made uſe of a ſcalpel for ſeparating the cellular ſubſtance from the muſcles beneath, as well as for ſeparating the muſcles from the bone; but I now find that both theſe parts of the operation may be done with the common amputating knife, with equal eaſe and expedition; and we ſhould avoid multiplying inſtruments, wherever the intention can be anſwered equally well, with a ſmaller number. The knife delineated in Plate XCVII., fig. 3., is the one I now prefer, after trying various forms of it: It is of a middling ſize, ſomewhat ſhorter than the one in common uſe, and perfectly ſtraight. The curved knife is ſtill uſed by ſome practitioners, but no good reaſon has been aſſigned for it.

If any ſurgeon ſhould find it difficult to ſeparate the muſcles from the bone with this knife, the inſtrument recommended by Mr Gooch, and delineated in Plate XCVII., fig. 4., may be employed.

I ſhall now deſcribe ſuch parts of Mr Alanſon's method of performing this operation as are peculiar to himſelf; and in order to convey the meaning of the author with exactneſs, I ſhall give it in his own words, from the ſecond and laſt edition of his book, page 51.

" Apply the tourniquet in the uſual way; ſtand on the outſide of the thigh; and let an aſſiſtant draw up the ſkin and muſcles, by firmly graſping the limb circularly with both hands. The operator then makes the circular inciſion as quickly as poſſible through the ſkin and membrana adipoſa down to the muſcles: He next ſeparates the cellular and membranous attachments with the edge of his knife, till as much ſkin is drawn back as will afterwards, conjointly with the following diviſion of the muſcles, cover the ſurface of the wound with the moſt perfect eaſe.

“ The aſſiſtant ſtill firmly ſupporting the parts as before, apply the *edge* of your knife upon the inner edge of the muſculus vaſtus internus, and at one ſtroke cut obliquely through the muſcles upwards as to the limb and down to the bone; or, in other words, cut in ſuch a direction as to lay the bone bare about two or three fingers breadth higher than is uſually done by the common perpendicular circular inciſion: Now draw the knife towards you, ſo that its point may reſt upon the bone, ſtill attending to keep it in the ſame oblique line, that the muſcles may be divided all round the limb in that direction by a proper turn of the knife; during which its point is kept in contact with, and revolves round, the bone.

“ The part where the bone is to be laid bare, whether two, three, or four fingers breadth higher than the edge of the retracted integuments; or, in other words, the quantity of muſcular ſubſtance to be taken out in making the double inciſion, muſt be regulated by conſidering the length of the limb, and the quantity of ſkin that has been previouſly ſaved by dividing the membranous attachments.

"The quantity of ſkin ſaved, and muſcular ſubſtance taken out, muſt be in ſuch an exact proportion to each other, as that, by a removal of both, the whole ſurface of the wound will afterwards be eaſily covered, and the length of the limb not more ſhortened than is neceſſary to obtain this end. However, it is to be obſerved, that the more muſcular ſubſtance we ſave, by fully giving the oblique direction to the knife, inſtead of dividing the membranous attachments, the better."

Mr Alanſon now gives ſome directions for the uſe of the retractor; for ſecuring the divided arteries with ligatures; and for the application of the flannel roller. Afterwards he proceeds thus:—"You are now to place the ſkin and muſcles over the bone in ſuch a direction as that the wound ſhall appear only in a line with the angles at each ſide; from which points the ligatures are to be left out, as their vicinity to either angle directs: The ſkin is eaſily ſecured in this poſture by long ſlips of linen or lint, about two fingers in breadth, ſpread with cerate or any other ointment: If the ſkin do not eaſily meet, it is beſt brought into contact by ſlips of linen ſpread with ſticking plaſter. Theſe are to be applied from below upwards acroſs the face of the ſtump, and over them a ſoft tow pledget and compreſs of linen, the whole to be retained by the many-tailed bandage, with two tails or ſlips to come from below upwards, to retain the dreſſings upon the face of the ſtump."

Mr Alanſon uſes a knife with a double edge, which he thinks preferable to the one commonly employed.

As I wiſh the author's ideas to be clearly underſtood, I think it right to add, that in p. 17. he directs the bone to be laid bare three or four fingers breadth higher than is uſually done by the common perpendicular inciſion of the muſcles; that is, that by the oblique direction of the knife, three or four fingers breadth of muſcular ſubſtance ſhould be ſcooped out. And, in page 21. he obſerves, "that a ſtump formed in the thigh, agreeably to the foregoing plan, if you bring the parts gently forwards after the operation, and then view the ſurface of the wound, may, in ſome degree, be ſaid to reſemble a conical cavity, the apex of which is the extremity of the bone;" and the parts thus divided, he obſerves, are obviouſly the beſt calculated to prevent a ſugar-loaf ſtump.

From what has been ſaid, it will appear, that Mr Alanſon's method of operating differs chiefly from that which I have adviſed above, in the manner of dividing the muſcles, and in the after poſition of the ſkin. Every ſurgeon is apt to be partial to that mode of operating which he has been accuſtomed to practiſe; but being always anxious to have this very important operation improved to the higheſt poſſible degree, I was reſolved to give Mr Alanſon's method a fair trial, being hopeful, from the accounts received of it, that I ſhould find it anſwer better even than that of which I have ſpoken ſo highly. I can with truth, however, aſſert, that it did not anſwer my expectation. The ſtumps formed by it are, indeed, much better than can be made by the uſual method of amputating; but the removal of ſuch a large portion of muſcular ſubſtance, as is done by Mr Alanſon's oblique inciſion, produces a hollow, that not only retains the matter, but prevents the ſtump from being ſo ſmooth and equal as when the ſkin is ſupported by a flat muſcular ſurface in the manner I have adviſed. Mr Alanſon, who is in the daily practice of it, may be able to obviate theſe difficulties; but I know that I cannot make ſuch a good ſtump in this manner as I always do in the other method of operating; nor is Mr Alanſon's own idea ſo completely anſwered by his method of operating. He very properly obſerves, page 36. that in the thigh we want a ſufficient cuſhion between the bone and machine to be uſed in walking;

ing; that the more muſcular ſubſtance that is ſaved, the farther will the point of bone on which the preſſure principally produces inconvenience, be removed from the ſurface of the machine; and likewiſe, that a more vigorous circulation will be kept up all round the extremity of the bone and ſtump, which leſſens the danger of exfoliation. Now, it is obvious, that the end of the bone will not be ſo much covered with muſcular ſubſtance when a conſiderable portion of the muſcles is removed by the oblique inciſion as when they are allowed to remain; nor will the circulation be ſo vigorous round the end of the bone.

But admitting Mr Alanſon's method of operating to be in every point equal to the other, the greater difficulty of performing it is a weighty objection againſt it. Indeed few, I believe, will be able to divide the muſcles by the oblique inciſion without mangling the ſkin, even with the explanation given by Mr Alanſon in the laſt edition of his book. Accordingly we find, in page 204. that this actually happened in the hands of an expert ſurgeon, Mr Lucas of Leeds, even where the diviſion of the muſcles was not begun cloſe under the retracted integuments, but a little lower. Nor will this be an uncommon occurrence, if the muſcles are divided with the edge of the knife, as is directed by Mr Alanſon. I have divided them with the point of the knife, but with difficulty; for the point cannot be eaſily carried round to the height of three or four fingers breadth above the retracted ſkin, ſo as to make a ſmooth equal cut. I do not ſee how the edge of the knife can be applied to cut ſo obliquely upwards without hurting the ſkin; and yet Mr Alanſon's words are, "apply the edge of your knife, and at one ſtroke cut obliquely through the muſcles," &c. He deſires, indeed, that the inciſion may be finiſhed with the point; but I do not underſtand how it can be done without cutting the ſkin, if the point be not employed from firſt to laſt in the diviſion of the muſcles. Indeed, Mr Alanſon himſelf admits that there is difficulty in this part of the operation; for in page 18. he ſays, “ that, while one aſſiſtant continues a firm and ſteady elevation of the parts, another ſhould attend to preſerve the ſkin from being wounded as the knife goes through the muſcles at the under part of the limb.” This, of itſelf, appears to be a material objection to this method of operating: For two aſſiſtants, whoſe hands are all employed nearly at one point, muſt be apt to embarraſs not only each other but the operator: And beſides, it muſt often happen, that two aſſiſtants cannot be procured.

With reſpect to the line of direction in which the wound ſhould be cloſed, Mr Alanſon obſerves, page 67., if it be formed from above downwards, the cicatrix will generally be found directly oppoſite to the bone; by which, in walking with an artificial leg, the point of preſſure muſt be upon the new-formed ſkin; which he thinks will be avoided by forming the line in the contrary direction from ſide to ſide: In which caſe, after the cure is complete, it will be found, that in conſequence of the more powerful action of the flexor muſcles, the cicatrix is drawn downwards, and the extremity of the bone is therefore covered with the old ſkin; by which the greateſt preſſure falls upon this part, and not upon the new-formed ſkin.

I have not found, however, that this argument is of much importance; for this retraction of the flexor muſcles to which Mr Alanſon alludes, is in a great meaſure owing to the cuſtom of elevating the ſtump after the operation, and may be prevented by keeping it lower than the reſt of the body, in the manner I have mentioned. And beſides, the bone is ſo well covered with muſcular ſubſtance, and the cicatrix ſo narrow when the operation is rightly done, that I have not met with a ſingle inſtance of any inconvenience ariſing from this circumſtance mentioned by Mr Alanſon: Whereas, the lodgment of matter proves always ſo troubleſome and pernicious, and would in all probability occur ſo frequently, were the practice generally adopted of making a tranſverſe opening inſtead of a longitudinal one upon the face of the ſtump, that this appears to be a ſufficient reaſon for preferring the former.

With a view to prevent that inequality on the ſurface of the ſtump, which ariſes from the retraction of the flexor muſcles of the thigh, I have in ſome caſes divided theſe muſcles an inch lower than thoſe of the reſt of the limb. After dividing the ſkin and cellular ſubſtance with a circular inciſion in the uſual way, this is eaſily done; and it prevents this inconvenience in the moſt effectual manner: But it is not neceſſary when the ſtump is treated in the manner I have mentioned.

Whether others may deem theſe obſervations upon Mr Alanſon's method of amputating important or not, I cannot determine; but as they appeared to me to be of conſequence, I thought it my duty to offer them.

It is but juſtice, however, to remark, that the public is much indebted to Mr Alanſon for his aſſiduity in endeavouring to improve this very important operation, and for the many uſeful practical remarks contained in his publication.

SECTION V.

Of Amputating the Leg.

IN amputating the thigh I have obſerved, that as much of the limb ſhould be ſaved as can be done with ſafety; for the longer the ſtump the more utility is derived from it: But in amputating the leg, it has hitherto been a general rule to take it off a little below the knee, even where the diſeaſe is ſeated on or near to the ankle, and where accordingly the operation might be performed much lower. The reaſon given for this is, that a few inches of the leg being ſaved, anſwers as a ſufficient reſt to the body in walking when the limb is inſerted into the box of a wooden leg; and when much more of it is left, that it proves troubleſome both in walking and ſitting, without being attended with any particular advantage.

Were we to conclude, that the common practice of bending the joint of the knee and reſting upon the anterior part of the leg was neceſſary, this method of operating a little below the knee would be admitted as the beſt: But as we have now had many inſtances of patients walking equally well with machines, ſo contrived as to admit of the uſe of the knee-joint; as theſe machines, by reſembling the human leg, are much more pleaſing to the eye than the wooden ones in common uſe; and as the operation may be done with much more eaſe and ſafety to the patient a little above the ankle, I am of opinion that it ſhould always be done here whenever it is practicable, inſtead of the ordinary place a little below the knee.

The operation is eaſier performed a little above the ankle than at the upper part of the leg, by the parts to be divided being leſs extenſive; for the diameter of the leg is here conſiderably leſs; and it is done with more ſafety by our being able to cover the bone more completely with ſoft parts, ſo as to accompliſh a cure in the ſame manner and equally ſoon as in the thigh: Whereas, immediately below the knee, the bones are not only larger, but there is ſuch a ſcarcity of ſoft parts, that the cure proves always much more tedious, notwithſtanding all our endeavours to promote it; inſomuch, that in operating at the uſual place, about four inches beneath the patella, the ſore, with all the attention we can give to it, will ſeldom heal in leſs than ten or twelve weeks; and in the common method of forming the double inciſion, it will even require four or five months: Whereas, when the operation is rightly performed a few inches above the ankle, a cure may, for the moſt part, be affected in a fortnight or three weeks.

It is true that a method of amputating beneath the knee has been propoſed, by what is termed the Flap Operation, and by which a cure may be more ſpeedily obtained than in the uſual way of operating; but ſtill it is tedious, and at the ſame time liable to other objections, which I ſhall have preſently occaſion to mention. I therefore conclude, that in every caſe that admits of it, amputating a little above the ankle is preferable to operating immediately below the knee.

We are next to determine the moſt proper place for the operation, when we are prevented by the extent of the diſeaſe in the leg from amputating lower than the uſual place beneath the knee. Where the upper part of the leg is ſound, it has hitherto been a fixed maxim to amputate below the joint of the knee rather than above it.

While practitioners were unacquainted with the preſent improvements on this operation, they ſeem to have adopted this maxim, chiefly from finding that the body reſted more eaſily upon the ſound ſkin on the fore-part of the leg than on the ſtump of the thigh: But now that the operation, when done above the knee, may be ſo performed that the ſore will heal in leſs than one half of the time that is required when the leg is taken off immediately below the joint; and in ſuch a manner that the ſtump is covered with ſound ſkin, as well as with ſome muſcular ſubſtance, which admits of the patient reſting upon it with freedom; this reaſon, upon which the practice is chiefly founded, falls to the ground.

I have obſerved above, that the cure of a ſtump immediately below the knee is always tedious, owing to the great extent of bone at this place, and the natural deficiency of ſoft parts.

Upon the whole, therefore, I conclude, that amputation immediately below the knee ſhould ſeldom or never be adviſed: But as no innovation will at firſt be generally admitted, I think it right to deſcribe the method of operating when it is determined to amputate at this part.

The patient ſhould be placed upon a table and ſecured in the ſame manner as in operating above the knee. The tourniquet ſhould be applied a little above the knee, with the cuſhion upon the artery in the ham. The foot and leg ſhould be ſecured by an aſſiſtant ſitting before the patient, while the teguments are drawn up by another aſſiſtant towards the knee. The ſurgeon, ſtanding on the inſide of the leg, ſhould now with the knife, Plate XCVII. fig. 3. make a circular cut through the ſkin and cellular ſubſtance down to the muſcles, ſo far down upon the limb, that when as much of the teguments are ſeparated from the parts beneath as will cover the ſtump, the muſcles and bones may be divided immediately below the inſertion of the flexor tendons of the leg. The interoſſeous ſoft parts muſt be divided either with the point of the amputating knife or with the catline, Plate XCVII. fig. 2. The retractors,

tors, Plate XCVIII. fig. 2. and 3. muſt now be applied ſo as to ſupport and protect the ſkin and other ſoft parts from the ſaw employed for dividing the bones. This being done, and the veſſels ſecured in the uſual way with ligatures, the teguments ſhould be drawn over the ſtump and retained with adheſive plaſters, in the manner I have adviſed in amputating the thigh. The practice, indeed, ſhould be the ſame during the whole courſe of the cure; only, in the application of the flannel roller, there is no neceſſity for beginning at the top of the thigh: It ſhould receive, however, two or three turns above the knee, to prevent it from ſlipping down.

In ſeparating the adheſions of the ſkin from the parts beneath, as much of the cellular ſubſtance ſhould be taken along with it as can be got; otherwiſe the circulation in the ſkin itſelf is apt to become ſo languid as to prevent it from adhering to the parts on which it is applied. It will be found too, that more attention is neceſſary to deſtroy the attachments of the ſkin in this ſituation, particularly on the fore-part of the leg, than in the thigh, owing to the cellular ſubſtance being more condenſed where it lies ſo contiguous to the bone, than in the thigh, where the muſcles intervene. And as this ſtate of the cellular membrane prevents the teguments from retracting freely after they are divided; and as they cannot even be pulled ſufficiently up by the aſſiſtant, it is neceſſary to fold ſuch of them as are ſeparated from the parts beneath, back upon the ſound ſkin, before the diviſion of the muſcles is attempted; otherwiſe the ſkin will either be cut with a knife, or the muſcles will not be divided ſo high as they ought to be.

Always at this part of the leg, and in a few caſes immediately above the ankle, I have found it neceſſary to fold the ſkin back in this manner; but hitherto no inſtance has occurred in the thigh, where the operation might not have been done merely by pulling the teguments up, in the manner I have formerly mentioned.

I have deſired above, that in this operation the ſurgeon ſhould ſtand on the inſide of the leg: By this, if the knee and foot are turned inwards, ſo as to raiſe the fibula, the ſaw may be applied in ſuch a manner to both bones as to divide them nearly together, the ſureſt method of preventing them from breaking when nearly ſawn through: Whereas, on ſtanding on the outſide of the patient, the fibula is more apt to be left to the laſt; at the ſame time that the ſaw is applied upon the ridge of the tibia, ſo as to act upon its longeſt diameter, by which it is not ſo quickly divided.

In operating above the ankle, that ſpot ſhould be fixed upon that will leave the ſtump of the moſt convenient length for being fitted with a leather machine reſembling the other leg. And I find from obſervation, as well as from information obtained from Mr Wilſon, a late ingenious tradeſman of this place, that nine inches from the joint of the knee is the beſt length for this purpoſe; for it affords a ſufficient ſupport to the machine, and at the ſame time prevents it from being ſo heavy and clumſy as when the leg is left of a greater length: for when taken off immediately above the ankle, the ſtump muſt go down to the very bottom of the machine, which muſt therefore be thicker and heavier at the ankle than it otherwiſe might be; at the ſame time that it will not correſpond ſo exactly as it otherwiſe would do to the ſize of the other leg.

In addition to what I have ſaid upon the method of amputating the leg immediately below the knee, I may obſerve, that, in operating above the ankle, it ſhould be done exactly as I have adviſed in deſcribing the amputation of the thigh: Only in this ſituation, inſtead of muſcles, we find a portion of both bones covered merely with ſkin and cellular ſubſtance; but as the cellular membrane is here commonly ſufficiently lax, and in greater quantity than in the upper part of the leg, it is not only more eaſily ſeparated from the perioſteum, but ſerves to give the bones a more complete covering: By which, when the operation is properly done, the cure for the moſt part is accompliſhed in leſs than three weeks, and the ſurface of the ſtump is equal, and every where covered with ſound ſkin.

SECTION VI.

Of Amputating with a Flap.

IN amputating in the uſual way, the cure was ſo extremely tedious; the health of the patient was thereby ſo much injured; and the ſtumps, when healed, were ſo pyramidal, and ſo thinly covered with ſoft parts, that another method of operating, as I have obſerved above, was propoſed upwards of a hundred years ago; in which an attempt was made to obviate theſe difficulties, by preſerving a flap of muſcles and ſkin for the purpoſe of covering the ſtump.

This was firſt propoſed by one Loudham, a Britiſh ſurgeon: It was afterwards practiſed in Holland, Germany, Switzerland, and France; and more lately by ſome individuals in Britain and Ireland: But it has never been received into general uſe, nor is it probable that it will ever be frequently performed.

The chief objections to it were, the difficulty of reſtraining hemorrhagies when they happened to recur after the flap was applied and fixed in its ſituation with ſutures, for in order to diſcover the bleeding arteries, it was neceſſary to undo the whole; the flap not adhering uniformly over the whole ſurface of the ſtump; and the pain, inflammation, and tenſion, that ſupervened to this operation, being much more ſevere than after the uſual method of operating.

To remove theſe difficulties, it was propoſed, about forty years ago, by Mr O'Halloran, an ingenious ſurgeon of Limeric, to dreſs the ſtump and flap as ſeparate ſores for the firſt twelve days; when the riſk of hemorrhagy being over, the ſymptoms of pain, inflammation, and tenſion, ſubſided, and ſuppuration eſtabliſhed, we are directed to turn the flap back upon the ſurface of the ſtump, and by means of plaſters, compreſſion, and bandage, to ſecure it in this ſituation till they unite.

By this improvement the operation was rendered more ſafe and certain; and it is probable that it would gradually have come into general practice, if the improved method of operating, that I have already deſcribed, had not in the mean time been introduced: But although this will probably continue to be generally preferred, yet in particular ſituations, the operation with the flap may with much propriety be employed. Wherever the divided parts cannot be properly covered with ſkin in any other manner, it ought certainly to be done with a flap: And this will always be the caſe in amputating the arm at the ſhoulder, and the thigh at the hip-joint, as well as in removing any of the fingers or toes: It may likewiſe by ſome be preferred to the method of operating that I have deſcribed, when it is reſolved to amputate immediately below the knee; for the tuguments being in this part extremely thin, the ſtump cannot in any other manner be ſufficiently covered. But for the reaſons that I have given, it can never be neceſſary, either above the knee; immediately above the ankle; nor in the arm or fore-arm. Some, however, may continue to prefer it, even in theſe parts; ſo that it will be proper to deſcribe the method of doing it in all of them; which I ſhall therefore do in the following Sections.

SECTION VII.

Of Amputating at the Hip-Joint.

THE amputation of the thigh at the hip-joint has always been conſidered as one of the moſt hazardous operations: It has therefore been very ſeldom performed. Indeed ſurgeons in general have ſpoken of it as one of thoſe operations which authors might deſcribe, but which would never be practiſed; and when we conſider the great ſize of the blood-veſſels which ſupply theſe parts: the difficulty of commanding the hemorrhagy during the operation; and the very extenſive wound which, in the uſual method of operating, muſt neceſſarily have enſued here; we will not be ſurpriſed at the averſion that has generally prevailed againſt it.

But if theſe difficulties can be removed; if danger from hemorrhagy can be prevented during the operation, as well as afterwards; if the ſore can be ſo completely covered with ſkin as to be healed in the courſe of a few weeks; and if caſes ever occur that would otherwiſe end in the death of the patient; we ſurely would not heſitate to adviſe it. Now, I hope to make it appear, that the operation may be done with very little loſs of blood; and that as much ſkin may be ſaved as will cover the ſore entirely: And no practitioner will doubt of diſeaſes taking place at the top of the thigh, which cannot be removed but by amputating the limb.

Having already treated fully of the cauſes by which amputation of limbs may become neceſſary, I ſhall now refer to what was ſaid upon that part of the ſubject; and at preſent I ſhall only obſerve, that gun-ſhot wounds, accompanied with fractures of this part of the bone, ſpina ventoſa, or caries of the head of the femur, will be the moſt frequent cauſes of amputating at the joint of the hip. When the operation is to be performed, it may be done in the following manner.

The patient ſhould be placed upon a table; and it will be found that the parts that are meant to be divided will be brought moſt clearly into view by laying him on the ſound ſide. In this ſituation, he ſhould be ſecured by two or three aſſiſtants. while another aſſiſtant takes the management of the limb.

Let a ſmall pad or cuſhion be now placed upon the femoral artery, immediately after it paſſes out from beneath Poupart's ligament into the thigh; and, by means of a tourniquet applied as near as poſſible to the top of the limb, let the circulation be completely ſtopped. Let the ſkin, membrana adipoſa, and tendinous facia of the thigh, be divided by a circular inciſion ſix inches from the top of the thigh; that is, at leaſt three inches beneath the circular band of the tourniquet. Let the retracted ſkin be pulled an inch upwards; and at the edge of it let the amputating knife be applied, ſo as with one perpendicular circular ſtroke the muſcles may be cut down to the bone. If the muſcles are freely divided, they will retract ſo much as to admit of ſufficient ſpace for ſecuring not only the femoral artery but all the muſcular branches. This being done, take a ſtrong round-edged ſcalpel, larger than the common ſize, and commencing at the upper edge of the circular cut on the poſterior part of the thigh, make a deep inciſion down to the bone, and carry it up of the ſame depth to a little above the great trochanter into the joint. Let a ſimilar cut be made on the oppoſite ſide of the limb, at a ſufficient diſtance from the femoral artery, and completely down to the bone. Let the two portions of fleſh be now diſſected from the bone, and the flaps formed by them be taken care of by aſſiſtants, while any artery that may be cut ſhould be tied as ſoon as it is obſerved. The joint being laid bare, ſome dexterity is required to diſengage the head of the femur from the acetabulum; for it is rendered difficult by being tied down with the ligamentum rotundum: But by turning the bone in different directions, and particularly by preſſing it inwards, where it yields moſt readily from the brim of the acetabulum being loweſt, the head of it may be ſo far turned out of the ſocket on the oppoſite ſide as to admit of the ligament being reached with the point of a ſcalpel or a firm probe-pointed biſtoury; but to accompliſh this, the muſcles muſt all be previouſly detached from the bone.

The head of the bone being taken out, and the limb removed, we may examine the ſtate of the acetabulum: for if it is ſound, our proſpect of a cure will be more favourable than if any part of it were carious. But in whatever ſtate the bones may be, our treatment of the ſore muſt be the ſame: We muſt endeavour to cure it as nearly as poſſible by the firſt intention: For which purpoſe, after removing all the coagulated blood from the ſurface of the wound; placing the muſcles as nearly as poſſible in their natural ſituations; and drawing the two flaps together, ſo as to cover the ſore as neatly as may be, they ſhould be ſecured in this ſituation with three or four ſutures introduced at the moſt proper points; by adheſive plaſters; and by proper compreſſes retained with a broad flannel roller paſſed different times round the body, and ſpirally over the ſtump; care being taken to leave the ligatures upon the arteries of a ſufficient length to admit of their being afterwards drawn out.

The patient ſhould now be laid in bed, and treated in other reſpects as I have adviſed in general after the Operation of Amputation: Only it muſt be remarked, that more than ordinary attention is required to prevent and remove ſuch febrile ſymptoms as uſually ſucceed to amputation; for where ſuch a conſiderable part of the body is ſuddenly taken away, almoſt a fourth part of the whole, we may reaſonably conclude that the effect produced by it upon the ſyſtem muſt be conſiderable. If the patient is plethoric, it will be proper to diminiſh the quantity of blood; in the firſt place by venæſection, and afterwards by a low diet: Indeed moderate living ſhould be perſevered in, if not for life, at leaſt for a great length of time.

The dreſſings may be removed at the uſual time, and in the courſe of ten or twelve days the ligatures may be all taken away; at which time, any part of the ſore that remains open may be covered, by drawing the ſkin over it, and ſecuring it with adheſive plaſter. In ſuch an extenſive ſore, it is indeed probable that matter may collect in different parts beneath the ſkin; for the preſſure applied upon it, will not be ſo equal as in common caſes of amputation: But the inconvenience ariſing from this will not be great; for if the matter cannot be diſcharged by altering the preſſure, it will be eaſily done with the point of a lancet, by which this obſtruction to the cure will be removed.

At all times this will neceſſarily be conſidered as a very formidable operation; but when performed in the manner I have adviſed, much of the hazard, and many of the inconveniencies uſually ſuppoſed to attend it, will be removed: Nor ſhould any practitioner accuſtomed to operate, heſitate in performing it, when the life of a patient will otherwiſe be endangered. By the tourniquet, we effectually command the circulation in the limb till all the large bloodveſſels divided by the circular inciſion are tied; and by ſecuring the different arteries that are cut in making the longitudinal inciſions as ſoon as they appear, the loſs of blood will be inconſiderable: Nor will there be any riſk of hurting the femoral artery in the courſe of ſeparating the flap in which it is ſeated from the bone, if it is done with caution.

It may be alleged, that by this method of operating, more of the teguments and muſcles will be ſaved than are neceſſary for covering the ſore; but it muſt be remembered,

membered, that the ſore will here be very extenſive, and that the divided muſcles will retract conſiderably. And beſides, the tourniquet could not be applied if the firſt cut was much higher than I have directed; by which the operation would neceſſarily be rendered much more dangerous: Nor can any riſk enſue from the teguments and muſcles being left ſomewhat longer than might juſt be neceſſary, while much inconvenience would ariſe from their being deficient.

In the ſixth volume of the Medical Commentaries of Edinburgh, a caſe is recorded, in which the thigh was amputated at this joint by Mr Kerr, ſurgeon in Northampton. In this caſe, the diviſion of the femoral artery was reſerved to the laſt; nor was the tourniquet employed. No hemorrhagy indeed occurred; but there was ſurely more riſk of this than if the operation had been done in the manner I have adviſed: Nor could the operator uſe ſuch freedom with the bone, in removing the head of it from the ſocket, as long as the bloodveſſels remained undivided. I may remark, however, that this caſe affords an inſtance of this operation being practiſed with ſafety: For although the patient died, yet ſhe lived eighteen days after the operation, and at laſt died from a different cauſe, when all riſk of hemorrhagy was over, and when the ſore had even a favourable appearance.

SECTION VIII.

Of the Flap Operation immediately above the Knee.

WHEN this operation is to be performed above the knee, it may be done either with one or two flaps, but it will commonly ſucceed beſt with one. The flap anſwers beſt on the fore-part of the thigh; for here there is a ſufficiency of ſoft parts for covering the bone, and the matter paſſes more freely off than when the flap is formed behind.

The patient being placed upon a table, the tourniquet being applied in the uſual way at the top of the thigh, and the teguments drawn firmly up and retained by an aſſiſtant, the extent of the intended flap ſhould be marked with ink. A perſon much accuſtomed to this operation may not require this aſſiſtance; but it will be done with more neatneſs and accuracy if the form and extent of the flap are previouſly marked.

The extreme point of the flap ſhould reach to the end of the limb, unleſs the teguments are in any part diſeaſed; in which caſe, it muſt terminate where the diſeaſe begins, and its baſe ſhould be where the bone is to be ſawn. This will determine the length of the flap; and we ſhould be directed with reſpect to the breadth of it by the circumference of the limb: For, the diameter of a circle being ſomewhat more than a third of its circumference, although a limb may not be exactly circular, yet by attention to this, we may aſcertain with ſufficient exactneſs the ſize of a flap for covering a ſtump. Thus, a flap of four inches and a quarter in length will reach completely acroſs a ſtamp whoſe circumference is twelve inches; but as ſome allowance muſt be made for the quantity of ſkin and muſcles that may be ſaved on the oppoſite ſide of the limb, by cutting them in the manner I have directed, and drawing them up before ſawing the bone; and as it is a point of importance to leave the limb as long as poſſible, inſtead of four inches and a quarter, a limb of this ſize, where the firſt inciſion is managed in this manner, will not require a flap longer than three inches and a quarter, and ſo in proportion according to the ſize of the limb. The flap at its baſe ſhould be as broad as the breadth of the limb will permit, and ſhould be continued nearly, although not altogether, of the ſame breadth to within a little of its termination, where it ſhould be rounded off ſo as to correſpond as exactly as may be with the figure of the ſore on the back part of the limb. This being marked out, the ſurgeon ſtanding on the outſide of the limb ſhould puſh a ſtraight double-edged knife with a ſharp point to the depth of the bone, by entering the point of it at the outſide of the baſe of the intended flap; and carrying the point cloſe to the bone, it muſt here be puſhed through the teguments at the mark on the oppoſite ſide. The edge of the knife muſt now be carried downwards, in ſuch a direction as to form the flap according to the figure marked out; and as it draws towards the end, the edge of it ſhould be ſomewhat raiſed from the bone, ſo as to make the extremity of the flap thinner than the baſe; by which it will apply with more neatneſs to the ſurface of the ſore. The flap being ſupported by an aſſiſtant, the teguments and muſcles of the other parts of the limb ſhould, by one ſtroke of the knife, be cut down to the bone about an inch beneath where the bone is to be ſawn; and the muſcles being ſeparated to this height from the bone with the point of the knife, the ſoft parts muſt all be ſupported with the leather retractors, Plate XCVIII. fig. 4. till the bone is ſawn, and any ſplinters that may be left, are cut off. All the arteries that diſcharge much blood muſt now be ſecured in the uſual way with the tenaculum, the ligatures being left of a ſufficient length for hanging out at the edge of the flap.

The ſkin and muſcles ſhould now be drawn down and ſecured with a flannel or cotton roller, in the manner I have adviſed when a leg is amputated with a circular inciſion; and the flap may now be laid down over the ſurface of the ſore, ſo as to effect a cure as much as poſſible by the firſt intention; or it may be dreſſed as a ſeparate ſore, agreeably to the practice of Mr O'Halloran, according to the judgment of the operator. If the flap is to be applied immediately, the coagulated blood ſhould be carefully ſponged out, and it ſhould be ſecured to the muſcles and teguments ſurrounding the reſt of the ſtump by three or four ſutures paſſed at leaſt three quarters of an inch into the muſcular part of it: But care ſhould be taken not to draw the ligatures ſo tight as to create much irritation or pain. The under part of the ſtump ſhould now be covered with a large pledget of common cerate; and a cuſhion of ſoft tow being laid over it, the whole ſhould be ſecured in the manner I have formerly adviſed, with croſs ſtraps of linen and a few turns of a circular roller.

In three or four days, the dreſſings may be renewed; and as ſoon as the ligatures are all removed, and the tenſion and inflammation induced by the operation abated, any part of the ſore that was not covered at firſt may now have the ſkin drawn over it, and ſecured with adheſive plaſters.

But if Mr O'Halloran's method is to be adopted, the eaſieſt mode of proceeding is this. The muſcles and teguments being drawn down and ſecured with the roller, let the whole ſurface of the ſtump be covered with a pledget of ſoft lint ſpread on both ſides with any ſoft emollient ointment: Let the flap be laid down upon this; and another pledget of the ſame kind being laid over the whole with a cuſhion of tow and a compreſs of ſoft linen, the croſs ſtraps and circular roller ſhould be employed to ſupport them, but with gentle preſſure. At the end of three or four days, the dreſſings may be renewed in the ſame manner; and about the twelfth or fourteenth day, or whenever the tenſion induced by the operation is removed, the ligatures being all taken out, and a proper ſuppuration eſtabliſhed, the flap may be brought into contact with the ſore beneath with a view to make them unite. For this purpoſe, any matter that may be obſerved upon the ſurface of either of them ſhould be gently removed with a ſoft ſponge; and the flap being laid down with as much exactneſs as poſſible, it may either be ſecured with adheſive plaſters ſupported by the bandage above mentioned, or two or three ſutures may be employed for it. This laſt method will give more pain than the other; but this will be amply compenſated by the flap being retained with more accuracy in its ſituation.

Farther experience muſt evince which of theſe methods ſhould be preferred, for as yet it is not determined. It is my own opinion, that the ſecondary union recommended by Mr O'Halloran is the beſt: For the pain, tenſion, and inflammation that enſue from the other, run often ſo high as to render it neceſſary to remove the dreſſings and even the ligatures; by which much additional trouble is given to the practitioner, and much diſtreſs to the patient: Whereas, when the tenſion and inflammation are gone before the flap is laid down, little or no pain is induced by it; nor is the cure effected in this manner more tedious: On the contrary, it would appear to be in general accompliſhed more quickly in this way than in the other. Even where the flap has not been applied to the ſore till the fourteenth day, the cure has been completed before the fourth week: Whereas, few, if any, cures, have been effected ſo early where the flap was applied immediately after the operation.

In operating with two flaps, the following is perhaps the eaſieſt method: The patient being placed upon a table, and the tourniquet applied, let the ſkin be drawn up by an aſſiſtant, and a circular inciſion made through the teguments and muſcles down to the bone at the inferior part of the limb, with the edge of the knife turned obliquely upwards: Let the ſharp-pointed knife, mentioned above, be now puſhed through the ſkin and muſcles on one ſide of the limb down to the bone, at that part where it is to be ſawn; and the under edge of the knife being turned obliquely outwards, let the muſcles be divided down to the circular inciſion. The teguments and muſcles on the oppoſite ſide of the limb muſt now be divided by a ſimilar inciſion, when any of the intermediate ſoft parts that may have been left muſt likewiſe be cut; and the bone being ſawn, and the veſſels ſecured with ligatures, the cure may either be attempted by laying the flaps together immediately, or they may be kept ſeparate twelve or fourteen days, and treated afterwards in the manner I have adviſed above.

SECTION IX.

Of the Flap Operation below the Knee.

IN ſpeaking of this operation below the knee, it is not neceſſary to deſcribe all the ſteps of it. The views of the operator are the ſame here as in operating above the knee, and the method of effecting them is nearly ſimilar. After the previous ſteps of the operation are taken, the ſize and form of a flap ſufficient to cover a conſiderable part of the ſore muſt be marked out with ink, and this muſt be ſeparated from the parts beneath in the manner I have already adviſed: The reſt of the ſoft parts muſt now be divided, taking care to ſave as much of the teguments on the ſide of the limb oppoſite to the flap as with the flap itſelf will nearly or entirely cover the ſore; and the cure muſt afterwards be conducted, either by applying the flap immediately, or after the ſymptoms of pain, tenſion and inflammation induced by the operation are gone, and treated in the manner adviſed in the laſt ſection.

It muſt be obſerved, however, in operating beneath the knee, that the flap cannot be formed on the fore-part of the limb as is done in the thigh; for on this part of the leg there is no muſcular ſubſtance; and for this reaſon, we are adviſed by authors to form the flap on the back-part of the leg. But this is liable to one very important objection, the difficulty of preventing matter from lodging between the flap and the ſore after they are brought in contact; for it muſt be remarked, that it is moderate preſſure only that we dare venture to apply to the flap; ſo that it is ſcarcely poſſible to prevent the matter from collecting where it does not find a free vent below.

Inſtead of forming the flap from the muſcles of the back part of the leg, it may be done with more property upon the outſide of the limb, where there is a ſufficient quantity of muſcular ſubſtance for this purpoſe. The point of the knife ſhould be entered on the outſide of the ridge of the tibia at the part where the bone is to be ſawn; and being carried backwards in a direct line, and at a proper depth to the oppoſite ſide of the baſe of the flap, the edge of it muſt afterwards be carried down the line previouſly marked with ink as a direction for the form and length of it. In this manner the bones may be covered with a flap ſufficiently thick, while the matter that forms in the progreſs of the cure, finding a ready outlet by the inferior edge of the flap, will not readily lodge.

In operating immediately above the ankle, we are under the neceſſity of leaving the flap behind, for there is not a ſufficiency of ſoft parts to admit of it in any other part. But I have elſewhere obſerved, that the leg ſhould never be taken off ſo immediately above the ankle, as it leaves the ſtump too long for a machine to be rightly fitted to it for walking: But at nine inches from the condyles of the femur, which in an adult is the moſt proper length for this purpoſe, the flap may with propriety be formed, in the manner I have mentioned, on the outſide of the leg.

SECTION X.

Of Amputating the Foot, Toes, and Fingers.

WHEN the whole foot is diſeaſed, it becomes neceſſary to take off the limb at the part I have mentioned above the ankle; nay, this ſhould be done even where the parts about the joint are ſound, if all the reſt of the foot is diſeaſed: For although ſome have adviſed the foot to be amputated at the joint of the ankle, yet the practice ſhould not be adopted, as the ſore cannot be properly covered, nor is the ſtump when of this length ſo uſeful: But when a conſiderable part of the foot remains ſound, it ought undoubtedly to be ſaved, and the diſeaſed part of it only removed. I have ſeen a whole foot taken off, where two of the metatarſal bones only ly were diſeaſed: While, on the contrary, it ſhould be held as a fixed rule, to remove the diſeaſed parts alone, even where two of theſe bones only remain ſound; for with the aſſiſtance of a ſhoe properly ſtuffed, and a firm unyielding ſole, even a very ſmall part of the foot proves uſeful in walking; eſpecially when the bones on the inſide of the foot, or thoſe correſponding to the great toe, and thoſe next to it, are left.

When the middle part only of the foot is diſeaſed, the metatarſal bones on each ſide remaining ſound, theſe ſhould be left, and the diſeaſed part only taken out. In this caſe, the bones ſhould be taken out at the joint, whether they are diſeaſed through their whole length or not; for although inſtruments might be invented for cutting even a ſingle bone acroſs in the centre of the foot, the operation would neceſſarily be much more tedious, and more painful, than the removal of the bone at the joint, at the ſame time that little or no advantage would be derived from ſaving a ſmall portion at the end of it. But where one, two or three of the bones on either ſide of the foot are only partially diſeaſed, as in this caſe it becomes an object to ſave as much of the foot as poſſible, the operation ſhould be ſo conducted that the bones may be ſawn acroſs nearly at the termination of the diſeaſed parts.

In every caſe of amputation, it is an object of importance to ſave as much ſkin as will cover the ſore; eſpecially in amputating any part of the foot where the effect of friction is much to be dreaded in walking. In making the inciſion, therefore, at that part of the bone where the ſaw is to be applied, it ſhould be done in ſuch a manner, that a flap may be ſaved of a ſufficient ſize for covering the ſore. With proper attention this may always be done, nor is it often difficult: for the flap may be formed either above or below, or on one ſide of the toe, according as the teguments are ſound or otherwiſe. But it is proper to remark, that where the ſkin is ſound, it anſwers beſt to ſave it below, for in this ſituation it is firmer, and therefore more able to reſiſt the effects of preſſure.

This operation is moſt eaſily performed when the patient is placed upon a table. The tourniquet ſhould be applied above the knee, with a compreſs placed upon the artery in the ham: the limb ſhould be firmly ſecured by aſſiſtants; and on ſawing the bone, a piece of paſteboard, or thin ſplint of timber, ſhould be inſerted between it and the contiguous ſound bone, to protect the latter from the teeth of the inſtrument.

The diſeaſed parts being removed, and the divided arteries ſecured, the flap ſhould be applied as exactly as poſſible to the ſore, and retained with ſlips of adheſive plaſter and gentle preſſure with a flannel roller. If ſutures are employed, they ſhould be inſerted in ſuch a manner as to avoid the flexor and extenſor tendons of the toes and foot.

In amputating the toes and fingers, the operation was formerly done by one ſtroke with a chiſel and mallet; but this is liable to many objections, and has been long in diſuſe. In general, fingers and toes are amputated in the ſame manner with the larger extremities, either by preſerving a flap ſufficient for covering the ſore, and afterwards dividing the bone with a ſmall ſpring-ſaw, repreſented in Plate XCVIII., fig. 1., or by the double inciſion, performed in the manner I have adviſed in Section IV. of this Chapter. But inſtead of this, it has for ſeveral years been the practice of ſome individuals, to amputate fingers and toes at the joints; and whoever will give it a fair trial, will readily prefer it. The patient being placed upon a table, and the limb properly ſecured, a flap ſhould be marked with ink of a ſufficient ſize for covering the ſore. This being diſſected from the bone with a ſcalpel, and ſupported by an aſſiſtant, a circular inciſion i then made through the reſt of the ſoft parts a little below the joint, and on a line with the baſe of the flap. The lateral ligament is now to be cut; and in order to determine the point at which this ſhould be done, an aſſiſtant ſhould be directed to move the finger. This ligament being divided, the bones are eaſily diſlocated, when the remainder of the operation may be quickly finiſhed. If an artery is to be tied, it ſhould be done with the tenaculum. The flap muſt be applied to the ſore, and ſecured as neatly as poſſible with adheſive plaſters, and moderate preſſure with a flannel roller.

The only objection that has been made to this practice is, the ſuppoſed uncertain union of the contiguous ſoft parts with cartilage. But we now know, that there is no cauſe for this apprehenſion, and that a flap will unite as readily with cartilage as with bone, at leaſt I have uniformly obſerved this to be the caſe; and we find from Mr Alanſon's publication, that the practice has proved very ſucceſsful in the courſe of his experience.

SECTION XI.

Of Amputating the Arm at the Joint of the Shoulder.

THIS operation having always been conſidered as hazardous and difficult to perform, it has not frequently been attempted: But although it ſhould never be adviſed when our purpoſe can be accompliſhed by amputating lower, yet no practitioner of modern times will decline it, when the life of a patient cannot in any other manner be ſaved. Abſceſſes in the joint, caries of the humerus reaching to the joint, compound fractures extending to the head of the bone, gunſhot wounds and mortification, may render amputation of the arm at the ſhoulder neceſſary.

The operation may be performed with ſafety by any ſurgeon of ſteadineſs and experience, and who is poſſeſſed of an accurate knowledge of the anatomy of the joint and contiguous parts.

It may be done in different ways; but the following I believe to be the beſt.

The patient ſhould be placed upon a table of a convenient height, covered with a mattreſs and blanket; and he ſhould be laid upon his back, and properly ſecured by aſſiſtants, as near as poſſible to one ſide of the table.

The next object is to guard againſt hemorrhagy: For this purpoſe the tourniquet might be placed upon the upper part of the limb, in a manner ſimilar to what I have propoſed in amputating at the hip-joint. But here it is unneceſſary, as the blood may be completely ſtopped in its flow to the arm, by compreſſing the ſubclavian artery as it paſſes over the firſt rib: For this purpoſe, an aſſiſtant ſhould be properly placed with a firm cuſhion or compreſs applied upon the courſe of this artery directly above the clavicle, who with his finger ſhould make ſuch a degree of preſſure as may be required: It will readily be known whether it anſwers or not, by its influence on the pulſe at the wriſt.

The circulation being ſtopped, the diſeaſed ſhoulder ſhould be made to project ſomewhat over the ſide of the table; and the arm being ſtretched out and ſupported by an aſſiſtant at nearly a right angle with the body, a circular cut ſhould be made through the ſkin and cellular ſubſtance juſt at the inſertion of the deltoid muſcle into the humerus. The teguments may be allowed to retract about half an inch; and at the edge of the retracted ſkin, the knife may be applied ſo as to divide the muſcles with a perpendicular circular cut down to the bone. Thus far we proceed with the common amputating knife; but the remainder of the operation ſhould be finiſhed with a ſcalpel. With a firm round-edged ſcalpel a perpendicular inciſion ſhould now be made down to the bone, commencing at the acromion, about half-way between the centre of the deltoid muſcle and the inner edge of it, and terminating in the circular inciſion about an inch above or rather on the outſide of the brachial artery. This being done, a ſimilar cut muſt be made on the back-part of the arm, commencing at the ſame height with the other, and ending in the circular inciſion. This ſhould be at ſuch a diſtance from the firſt, that the two flaps formed by them both may be nearly of an equal breadth. The brachial artery ſhould be tied as ſoon as it is cut by the circular inciſion through the muſcles; and any anaſtomoſing muſcular branches of arteries that may be cut on the upper and back part of the joint, ſhould be tied immediately on being obſerved. The two flaps ſhould now be ſeparated from the bone, care being taken to avoid the large artery in diſſecting off that part of the flap with which it is connected. An aſſiſtant muſt ſupport the flaps ſo as to bring the capſular ligament of the joint into view; when an opening being made into it, the head of the bone will be eaſily diſlocated by drawing the arm backward;

ward; and this being done, the operation will be eaſily finiſhed, by dividing the remaining part of the ligament.

Any arteries that may have been cut about the joint being tied, the ligatures hanging out at the moſt depending part of the wound, and the parts cleared of coagulated blood, the two flaps ſhould be laid together ſo as to cover the joint as neatly as poſſible, and retained in their ſituation with two or more ſutures. A pledget of lint ſpread with any emollient ointment ſhould now be laid over the joint; and a ſoft cuſhion of tow or lint, with a compreſs of old linen, being applied over the whole, a flannel roller ſhould be employed to make moderate preſſure upon the joint; by which the flaps will be kept in contact with the parts beneath, which will not only facilitate their union, but will be the moſt effectual method of preventing the lodgment of matter.

In other reſpects, the patient ſhould be treated as I have adviſed in the preceding Sections when ſpeaking of Amputation in the Lower Extremities. With a view to prevent any riſk from hemorrhagy after the operation, an aſſiſtant of experience ſhould ſit with the patient for the firſt two or three days, with directions to apply preſſure above the clavicle in the event of any conſiderable quantity of blood being diſcharged, till the bleeding veſſel can be ſecured with a ligature. In the courſe of eight or ten days, the ligatures upon the arteries will come eaſily away. If matter collects beneath any part of the ſkin, it muſt be diſcharged; and if the patient is healthy, and no untoward circumſtance happens, a cure may ſoon be expected.

Till of late, it was the practice in this operation to tie the brachial artery and veins with a ligature before proceeding farther. This gave much unneceſſary pain, at the ſame time that it did not render the patient more ſecure. In the way I have mentioned, the operation may be performed with no riſk from the hemorrhagy; and by tying the artery at the extremity of the flap, ſeveral muſcular branches will be ſaved that would be deſtroyed by tying it near the axilla.

Mr Bromfield, in the firſt volume of his Obſervations and Caſes, has given the beſt account yet publiſhed of this operation. The principal difference between his method of doing it and the one that I have deſcribed, conſiſts in the latter being more ſimple, and therefore more eaſily performed. By dividing the muſcles down to the bone with a circular inciſion, the operation is more ſpeedily done than by cutting firſt one muſcle and then another, in the manner mentioned by Mr Bromfield. And as the attachments of the latiſſimus dorſi, the deltoid and pectoral muſcles, are removed by the arm being taken away, there is no neceſſity for proceeding with ſlowneſs and caution in dividing them; nor is it neceſſary to employ two ligatures upon the brachial artery, one conſiderably higher than the other, as is adviſed by that author; one ligature applied in the uſual way with the tenaculum is quite ſufficient, if it is done with care and attention. And Mr Alanſon very properly obſerves, in ſpeaking of this operation, that there is no neceſſity for ſcraping off the cartilage from the acetabulum of the joint, as is recommended by Mr Bromfield; for it is found, by experience, as I have obſerved in the laſt Section, that the teguments adhere to cartilages as readily as to bone.

SECTION XII.

Of Amputating the Arm.

THE general obſervations I have made upon the method of amputating the thigh and leg, apply equally to the amputation of the arm and fore-arm. At preſent, therefore, I ſhall only obſerve, that in amputating the arm, no more of it ſhould be removed than is diſeaſed; for the longer the ſtump is, the more uſeful it proves; and the ſame attention ſhould be given to the ſaving of teguments for covering the ſore that I have adviſed in amputating the leg. But it is proper to remark, that this may always be done both in the arm and fore-arm without the aſſiſtance of a flap: For there is in every part of both a ſufficiency of muſcles and cellular ſubſtance, for admitting of the ſore being

ing completely covered by amputating with the double inciſion, in the manner I have pointed out for this operation upon the thigh; and wherever this can be done, it ſhould be preferred to the method of operating with a flap.

CHAPTER XLV.

Of removing the Ends of BONES *in Diſeaſes of the* JOINTS.

THE amputation of limbs is more frequently adviſed for diſeaſes of the joints than for any other cauſe; and as this often happens where the reſt of the limb is ſound, it were to be wiſhed, that with ſafety and propriety we could remove ſuch parts as are diſeaſed, and leave thoſe that are ſound. In compound fractures and diſlocations, the ends of large bones have frequently been ſawn off, when ſuch parts of them have protruded as could not be replaced. The deficiency thus produced, has in moſt inſtances been ſupplied by nature; and thus the limbs have remained almoſt equally uſeful as before. In a few caſes, too, of diſeaſed joints, a cure has been obtained by the head of a bone being ſawn off. Among other inſtances of this to be met with in books, a remarkable one is recorded by a very ingenious and expert ſurgeon, Mr White of Mancheſter, who preſerved an arm by ſawing off the head of a diſeaſed humerus *. But Mr Park of Liverpool, was the firſt who ventured to propoſe it as a general remedy in affections of the joints †. Whether or not it will ſtand the teſt of experience, farther trials muſt determine; but in the mean time, the public are much indebted to Mr Park for the pains he has taken to introduce a leſs formidable remedy in place of amputation.

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* *Vide* Caſes in Surgery with Remarks, Part I. by Charles White, F. R. S. &c.

† *Vide* An Account of a New Method of Treating Diſeaſes of the Joints of the Knee and Elbow, by H. Park.

What Mr Park propoſes is, that inſtead of amputating a limb for any external violence done to a joint, for a white ſwelling, a caries, or any other affection, that the diſeaſed ends of the bones ſhould be ſawn off; when nature, he thinks, will commonly ſupply the deficiency of bone; by which the limb will be preſerved, and will prove more uſeful than any machine that artiſts can invent.

Mr Park ſuppoſes that this operation will be chiefly applicable to affections of the knee and elbow, and more particularly to thoſe of the latter; and he relates a caſe of white ſwelling of the knee in which it was practiſed with ſucceſs: The under extremity of the femur and the upper end of the tibia were ſawn off; no artery of importance was injured; and the vacancy produced by the removal of the ends of the bones was ſupplied with callus: In the courſe of ten weeks, a cure of the ſore was obtained; the limb became ſo firm that the man has ſince been able to go to ſea as a ſailor, and he does not even uſe a crutch.

This, however, is the moſt favourable view of the propoſal; and it is proper to remark, that in the courſe of the cure, much perplexity occurred from various circumſtances; particularly from the difficulty of preſerving the limb in a ſteady fixed ſituation; from the great depth of the wound; from the lodgment of matter; and from the formation of ſinuſes. By much attention on the part of Mr Park, all theſe difficulties were ſurmounted; but although the merits of the operation muſt be determined by farther trials, yet the riſk attending it appears to be ſo great, that there is much reaſon to think that it will never be generally practiſed.

For a more particular detail of the method of doing it, and of the after-treatment of the ſore, the publication itſelf muſt be conſulted; but for the advantage of thoſe who may not eaſily meet with it, the following ſhort account of the operation is inſerted in Mr Park's own words.

" An inciſion was made, beginning about two inches above the upper end of the patella, and continued about as far below its under extremity: Another, croſſing this at right angles, immediately above the patella, the leg being in an extended ſtate, was made through the tendons of the extenſor muſcles down to the bone, and nearly half round the limb; and the lower angles formed by theſe inciſions were raiſed ſo as to lay bare the capſular ligament: The patella was then taken out, and the upper angles were raiſed, ſo as fairly to denude the head of the femur, and to enable me to paſs a ſmall catling acroſs the poſterior flat part of the bone immediately above the condyles, taking care to keep one of the flat ſides of the point of the inſtrument quite cloſe to the bone all the way. The catling being withdrawn, an elaſtic ſpatula was introduced in its place, to guard the ſoft parts while the femur was ſawing through: Which done, the head of the bone thus ſeparated was carefully diſſected out: the head of the tibia was then with eaſe turned out and ſawn off, and as much as poſſible of the capſular ligament diſſected away, leaving only the poſterior part covering the veſſels; which, on examining, I had the ſatisfaction to find had not only eſcaped unhurt, but that it was not a very narrow eſcape: They had ſtill a pretty good covering, and had been, through the whole operation, far enough out of the courſe of the knife. It muſt be confeſſed, that the appearance of the wound was ſomewhat formidable, exhibiting a very large cavern with very thin parietes; and in ſhort, there ſeemed little wanting to complete the amputation: Yet as the limb below would not be deprived of any part of its nouriſhment, and as every healthy inciſed ſurface, as well of bone as of ſoft parts, has a natural tendency to granulate, I could not ſee any room to doubt, that nature would be able to repair the breach."

Mr Park afterwards informs us, that he attempted to perform the operation without making the tranſverſe inciſion: But he found it could not be done; and after ſpending ſome time in the attempt, it was thought adviſable to deſiſt from it. More than two inches of the femur, and rather more than one inch of the tibia, were removed; which were but juſt enough to admit of the leg being brought into a right line with the thigh, the previous contraction of the flexor muſcles being ſuch as to keep the two ſawn ends of bone in cloſe contact: This produced a conſiderable redundance of the teguments. To ſupport this, that it might not fall inward, and to keep the edges of the inciſion in appoſition till they ſhould acquire ſome degree of firmneſs, a few ſtitches were paſſed through the ſkin; not merely along the courſe of the tranſverſe inciſion, but upon that part of the longitudinal cut that extended up the thigh. The lighteſt ſuperficial dreſſings only were applied, and the limb placed in a caſe of tin from the ankle to the inſertion of the glutæus muſcle.

Mr Park very candidly enumerates ſeveral objections that may be made to this operation; but, at the ſame time, he thinks that all of them may be obviated. There are two, however, which, in my opinion, will always appear with force againſt it: The firſt is, that where the bones of large joints are ſo much diſeaſed as to render it neceſſary to remove them, the ſurrounding ſoft parts are commonly ſo much thickened, inflamed or ulcerated, as to render any attempt to ſave them very uncertain, and much more hazardous than the amputation of the limb: And the ſecond is, the high degree of inflammation that commonly ſucceeds to wounds of the larger joints.

With reſpect to the firſt of theſe, Mr Park himſelf wiſhes it to be underſtood, that it is chiefly in affections of the joints produced by external violence, that he thinks this operation will be peculiarly uſeful; and with reſpect to the laſt, he obſerves, that the heads of large bones have been frequently ſawn off, without any violent ſymptom taking place: And as he ſuppoſes this to be owing to the very free diviſion of the capſular ligaments, which in ſuch caſes muſt always happen, he thinks that the total removal of this ligament, which he adviſes in this operation, will in a great meaſure prevent it. I have obſerved above, that experience alone can determine upon the merits of this operation; but I cannot avoid remarking, that no neceſſity appears for the removal of any part of the capſular ligament. It may be highly proper to make the opening into it free and large; but to remove it, by diſſecting it off from the contiguous parts, muſt probably add to the riſk of the operation, by rendering the inflammation more ſevere than it otherwiſe might be; at the ſame time that it muſt neceſſarily render it much more painful as well as more tedious. Farther experience may, perhaps, ſet this in a different point of view: But at preſent I ſee no more reaſon for removing any part of the capſular ligament in this operation, than for the removal of the tunica vaginalis teſtis in the operation for the hydrocele; a practice now altogether laid aſide, even where the cyſt is much thickened.

CHAPTER XLVI.

Of ISSUES.

ISSUES are ſmall artificial ulcers that we form in different parts of the body, for the purpoſe of procuring a diſcharge of purulent matter.

As I have elſewhere treated fully of the advantages that may be derived from iſſues, and of the manner in which they ſeem to act in the cure of diſeaſes, it is not at preſent neceſſary to enter minutely upon this part of the ſubject: I ſhall, therefore, only obſerve, in general, that I am daily more and more convinced of the utility of iſſues in the cure of long continued ſores, of whatever kind they may be; and that I am ſtill of the opinion that they act ſolely by diſcharging a certain quantity of the ſerous parts of the blood; and not that they ſerve merely as drains for noxious humours, which, till of late, has been the prevailing opinion of practitioners *.

Among other errors in practice to which this opinion gave riſe, the choice of ſituation for iſſues was none of the leaſt remarkable. As it was imagined that ulcers as well as other local diſeaſes were produced by a determination of morbific humour to a particular ſpot, when iſſues were adviſed, it was conſidered as neceſſary to place them as contiguous to the affected part as poſſible, and always on the ſuperior part of the limb when the diſeaſe was ſeated on any of the extremities, in order to prevent the morbid matter from falling down to it. But as we now conclude that iſſues prove uſeful or otherwiſe merely by the quantity of matter which they

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* See Chapter IV. on the Theory and Management of Ulcers, where this ſubject is fully conſidered.

they afford, it appears to be of little importance where they are placed; and accordingly they may be inſerted wherever the patient thinks they will occaſion the leaſt inconvenience.

Some general rules, however, ſhould be obſerved in the introduction of iſſues: They ſhould never be placed immediately above a bone thinly covered,—nor directly above a tendon,—nor very contiguous to a large bloodveſſel or nerve,—nor upon the belly of a muſcle. The beſt ſituation for iſſues is that ſpace which lies between the tendons on the back part of the neck, where there is a conſiderable depth of cellular ſubſtance,—the middle of the humerus, near to the inſertion of the deltoid muſcle,—and a conſiderable hollow above the flexor tendon on the inſide of each knee. They may likewiſe be inſerted between two of the ribs, and on each ſide of the vertebræ of the back; or, in ſhort, wherever there is a ſufficient quantity of cellular ſubſtance for the protection of the parts beneath. It is proper, however, to remark, that the ſpot uſually fixed upon for iſſues is perhaps the moſt improper of any, I mean directly below the knee; where there is never much cellular ſubſtance; where the veins of the leg can ſcarcely be avoided; and where the peas are apt to hurt the contiguous tendons.

Iſſues may be formed in various ways: By corroding or removing the ſkin with epiſpaſtic applications;—by making an inciſion with a ſcalpel or lancet;—by the application of cauſtic;—and the introduction of a cord.

When an iſſue is to be opened by removing a portion of ſkin, a bliſter muſt be applied upon the ſpot, exactly of the ſize of the intended ſore; and on the bliſter being removed, a diſcharge of matter may be kept up, by dreſſing the part daily with any common ointment in which there is mixed a ſmall proportion of cantharides in fine powder: Or, it ſometimes proves ſufficient to uſe this irritating application, and a mild ointment of wax and oil alternately.

In forming an iſſue by inciſion, or with cauſtic, an opening muſt be made of ſuch a ſize as is ſufficient for affording a proper quantity of matter; and the aperture muſt be preſerved by inſerting daily into it ſome extraneous body covered with any mild digeſtive ointment, ſuch as baſilicon or linimentum Arcæi, while the whole muſt be ſecured with a proper bandage. Peas are commonly employed for this purpoſe. Kidney-beans anſwer very well; and ſome make uſe of gentian root, and of aurantia Curaſlaventia, uſually termed Orange Peas, turned into a proper form. When the opening is made by an inciſion, the ſkin ſhould be ſupported on one ſide by an aſſiſtant, and on the other by the left hand of the ſurgeon; who ſhould now, with a ſcalpel in the other, make a cut of a ſufficient length and depth for receiving the number of peas intended to be put into it, and thus the operation is finiſhed: But when done with cauſtic, more attention is requiſite. Many compoſitions of cauſtic paſte have been recommended; but

I have met with none that for this purpoſe anſwers ſo well as the lapis infernalis or cauſticum commune of different Diſpenſatories. It ſhould be firſt reduced to powder, and made into a paſte with water, or with ſoft ſoap, when as much of it ſhould be applied upon the ſpot where the iſſue is wanted as will make an opening of a proper ſize; but as it is apt to ſpread to the contiguous parts, ſome care is required to prevent it. For this purpoſe, a piece of leather ſpread with Burgundy pitch, or any adheſive plaſter, with a ſmall hole cut in the centre, ſhould be placed upon the part, with the hole directly on the ſpot where the cauſtic is meant to be applied The ſmall ſpot thus left uncovered, muſt now be ſpread with the cauſtic paſte; and over the whole there ſhould be laid another piece of leather ſpread with the ſame adheſive plaſter, ſo that no part of the cauſtic may eſcape. In the courſe of ten or twelve hours, the whole may be removed; for before this if the cauſtic is good, it will have produced an eſchar of a ſufficient depth. In the ſpace of three or four days, the eſchar will ſeparate from the contiguous ſound parts, when the opening formed by it muſt be filled with peas or ſome other of the ſubſtances I have mentioned.

When it is neceſſary to diſcharge a large quantity of matter by an iſſue, and eſpecially when we wiſh to have it from deep-ſeated parts, we do it by the introduction of a cord of cotton or ſilk, forming what is commonly termed a Seton. This we often employ with advantage in deep-ſeated pains, particularly in pains of the breaſt and ſides in phthiſis pulmonalis. In ſuch caſes it is commonly inſerted between two of the ribs; and it anſwers better in the direction of the ribs than when placed acroſs them, as is ſometimes done. A cord is alſo a frequent remedy in diſeaſes of the head, particularly in ophthalmia and other affections of the eyes; and in ſuch caſes it is uſually placed in the back part of the neck

In the introduction of a cord, the parts at which it is to enter and paſs out, ſhould be previouſly marked with ink; and the cotton or ſilk being put into the eye of the flat needle, Plate LIV. fig. 5. and the parts ſupported by an aſſiſtant, the needle ſhould now be puſhed in at one of the ſpots and carried out at the other, along with two or three inches of the cord, which ſhould be left hanging out. The irritation which the cord excites is ſoon followed by a plentiful diſcharge of matter, which may be increaſed or diminiſhed at pleaſure, by covering the cord daily, before it is drawn, with a mild or an irritating ointment.

In former times, it was a frequent practice to form iſſues by burning the parts into which they were to be introduced with the actual cautery; and in ſome parts of Europe it is ſtill continued: But as it is much more terrifying than any of thoſe that I have mentioned, and as it does not appear to be attended with any particular advantage, it is now in general laid aſide.

In China, Japan, and ſome other eaſtern countries, it is ſtill a prevailing practice, in deep-ſeated pains, to burn the parts affected down to the bone with moxa. Moxa is a light, ſoft combuſtible down, of a particular plant. A ſmall cone of it being wrapped up, the baſe of the cone is fixed upon the part with glue or mucilage; and fire being put to the oppoſite end of it, it is allowed to remain till the whole is conſumed; and if one application does not prove ſufficient, it is repeated once and again as long as it is neceſſary. The operation may be done equally well with fine flax; but although it has been ſometimes done in different parts of Europe, it will not probably be ever generally practiſed. I have known it, however, remove the moſt obſtinate ſciatic pains, where every other remedy had failed.

CHAPTER XLVII.

Of the Inoculation of the SMALLPOX.

THERE is cauſe to imagine, that almoſt all eruptive diſeaſes, as well as ſome others, may be communicated by inoculation: The practice, however, is confined to ſuch as are not apt to return; for no advantage would ariſe from inducing diſeaſes to which the ſyſtem might afterwards be liable. The plague has been communicated by inoculation; but in this country the ſmallpox, and of late the cow-pox, are the only diſeaſes that we are accuſtomed to inoculate. Some trials have indeed been made for inoculating the meaſles; but as yet they have not ſucceeded.

From the reſult of ſome experiments, there is reaſon to think, that no diſeaſe can be communicated by inoculating with the blood of an infected perſon. This, however, is not as yet preciſely determined; ſo that farther trials will be neceſſary to aſcertain it. In inoculating the ſmallpox and cow-pox, we employ the matter contained in the puſtules.

The proper period for inoculating,—the preparation of the patient,—and the ſubſequent treatment of the diſeaſe, are points that more particularly fall to the conſideration of the phyſician. The mode of communicating the infection is our only object at preſent.

In the more early practice of inoculation, it was cuſtomary to tie an infected thread round the arm or leg; to rub a little variolous matter upon any part of the body; or to inſert a piece of thread ſoaked in matter beneath the cuticle, with a ſmall needle, and to allow it to remain till there was reaſon to think that the infection had taken place. In any of theſe ways the diſeaſe may be communicated: But as by ſome of them there is cauſe to ſuſpect that a variolous atmoſphere may be produced, and that the diſeaſe may be thus induced in the ſame way as in the caſe of a common contagion, and conſequently that ſome of the advantages of inoculation may not be obtained from them, theſe modes of giving the ſmall-pox ought therefore to be laid aſide.

Till of late, inoculation was commonly performed by making an inciſion of about half an inch in length through the ſkin to the depth of the cellular ſubſtance: A bit of thread impregnated with variolous matter was then inſerted, and retained for two or three days with a compreſs and bandage. To this practice, however, the great unneceſſary pain attending it, and the aptneſs of the wound to degenerate into a diſagreeable ulcer, are ſtrong objections.

The preſent mode of inſerting the matter appears to be in every reſpect more eligible. The point of a lancet, previouſly covered with variolous or vaccine matter, is inſinuated through the cuticle ſo as to ſcratch or ſlightly injure the cutis vera. It might frequently indeed be ſufficient to paſs it through the cuticle only; but we do not ſo readily fail when a ſmall particle of blood follows the lancet. When the matter is recently taken in an early period of the diſeaſe, the lancet may be introduced without being moiſtened; but whenever the matter has become firm and hard, it ſhould be rendered ſoft with a drop of warm water, or by holding it in warm ſteam.

The operation may be done in any part of the body; but the arm is generally preferred. One ſcratch would for the moſt part prove ſufficient; but with a view to enſure ſucceſs, two or even three are commonly made at the diſtance of an inch from each other. It is to be obſerved, however, that when the matter takes effect in all the ſcratches, the inflammation that enſues being communicated from one to the other, is often conſiderable, and gives much pain and uneaſineſs. This is eaſily prevented by making only one ſcratch in each arm, which for ſeveral years paſt I have uniformly done.

In this method of inoculating, we never employ either bandage or compreſs; for the wound is ſo trifling that no kind of dreſſing is neceſſary: So that we readily ſee, at the end of a few days, whether the infection will take place or not; for in general, by the third or fourth day, if the operation is to ſucceed, the ſcratches made with the lancet become red, ſwelled, and ſomewhat painful.

CHAPTER XLVIII.

Of Preventing or Diminiſhing PAIN *in* CHIRURGICAL OPERATIONS.

TO be able to alleviate the miſery of thoſe who are obliged to ſubmit to dangerous operations, muſt afford the higheſt gratification to every practitioner: And as pain is the moſt dreadful part of every operation, it neceſſarily demands our moſt ſerious attention.

The pain induced by operations may be leſſened in different ways: By diminiſhing the ſenſibility of the ſyſtem; and by compreſſing the nerves that ſupply the parts upon which the operation is to be performed.

Narcotics of every kind might be employed for the purpoſe of leſſening general ſenſibility; but nothing anſwers this with ſuch certainty and effect as opium.

But as opiates, when given in doſes large enough for this purpoſe, are apt to induce ſickneſs and vomiting, I ſeldom venture on giving them before an operation, unleſs the patient has previouſly been in the habit of uſing them. In general they prove moſt uſeful when given immediately after, when they very commonly alleviate that pungent ſoreneſs of which patients at this time uſually complain; and by continuing to give them in adequate doſes from time to time, we are often enabled to keep the patient eaſy, till relief is obtained by the formation of matter, or by the removal of that inflammatory tenſion that uſually takes place after every capital operation: And as this proves not only highly comfortable to the patient, but tends in the moſt effectual manner to moderate the febrile ſymptoms that commonly occur, it ſhould never be omitted.

It has long been known, that the ſenſibility of any part may not only be leſſened, but even altogether ſuſpended, by compreſſing the nerves that ſupply it: And accordingly, in amputating limbs, patients frequently deſire the tourniquet to be firmly ſcrewed, from finding that it tends to diminiſh the pain of the operation.

The effect of this, however, being inconſiderable, it has lately been propoſed by Mr James Moore of London, to compreſs the principal nerves ſo completely as to render the parts beneath altogether inſenſible. In Plate CI. an inſtrument is delineated, by which this may be very effectually done.

Whether or not it will anſwer with eaſe and certainty, experience alone muſt determine: But, in the mean time, we are much indebted to the ingenious author, for affording a hint that eventually may tend to mitigate the ſufferings of thoſe whom neceſſity obliges to ſubmit to chirurgical operations. All that this inſtrument ſeems to require in order to render it perfect, is the power of compreſſing the nerves of a limb without affecting the veins; for as it is found that the nerves muſt be compreſſed for a conſiderable time, at leaſt an hour, before the parts beneath are rendered altogether inſenſible, the veins could not be compreſſed for ſuch a length of time but with the riſk of burſting. With a view to prevent ſuch a diſagreeable occurrence, Mr Moore propoſes that one of the veins in the limb ſhould be opened. But as this might prove hurtful to weakly patients, in whom it is often of importance to guard againſt the loſs of blood, it would be better to avoid it, by having the inſtrument formed in ſuch manner, that it might compreſs the principal nerves only, without materially affecting the veins. This will not indeed be eaſily done, as the nerves uſually run at no great diſtance from the veins: But the ſame purpoſe may perhaps be anſwered by compreſſing the arteries of the limb for a minute or two before any preſſure is applied to the veins; by which the latter may be previouſly emptied.

CHAPTER XLIX.

Of MIDWIFERY.

SECTION I.

General Obſervations on Midwifery.

MIDWIFERY being now conſidered as a diſtinct branch of chirurgical practice, a minute account of it will not be expected in a Syſtem of Surgery. For more particular information, thoſe authors who have written upon it may be conſulted: But I have judged it proper to delineate the inſtruments uſually employed in

Midwifery; and to deſcribe two operations, which, although immediately connected with this branch, are yet more frequently performed by the ſurgeon than the accoucheur; namely, the Cæſarean operation, and the diviſion of the ſymphyſis pubis.

A great variety of inſtruments have been invented by practitioners in midwifery; almoſt every publication, indeed, upon this ſubject, announces ſome new invention. It is only thoſe inſtruments, however, which experience has ſhown to be uſeful, that I mean to deſcribe: They are not numerous; and are all delineated in Plates CII. CIII. CIV. CV. and CVI.

With the forceps in Plate CII. fig. 2. we lay hold of the head of the child when the mother is much enfeebled and the contraction of the uterus not ſufficient to expel the child in the uſual way: And when delivery cannot be effected even in this manner, or by turning the child, and bringing it away by the feet, as ſometimes happens from the pelvis being much diſtorted, we employ the crotchet repreſented in Plate CIII. fig. 1. for bringing the child away piecemeal, after leſſening the ſize of the head by an opening made in the ſkull for diſcharging the brain with the ſciſſars repreſented in fig. 2. of the ſame Plate.

The neceſſity, however, of uſing any of theſe inſtruments I believe to be exceeding rare: They are indeed frequently employed; but this proceeds in a great meaſure from impatience on the part of practitioners, who often force the delivery of the child, when nature, if left to herſelf, would effect it in a much more eaſy manner. This fact is ſo certainly well-founded, and is of ſuch general importance, that practitioners of every deſcription, and more eſpecially thoſe who are newly entering on buſineſs, ſhould never loſe ſight of it. By not meeting with that attention which it merits, both the forceps and crotchet are daily employed with too much freedom, to the diſgrace of the art, and often with irreparable injury both to the mother and child.

In ſome caſes it happens, that delivery cannot be accompliſhed even with the aſſiſtance of theſe inſtruments, owing to the brim of the pelvis being ſo narrow that it will not allow any part of the child to paſs. In ſuch circumſtances, the Cæſarean Section, as it is termed, uſed formerly to be practiſed; but the danger attending that operation being ſo great that the mother was ſeldom ſaved by it, Mr Sigault of Paris, about four and twenty years ago, propoſed the diviſion of the ſymphyſis pubis, for the purpoſe of increaſing the diameter of the pelvis, and for extracting the child in the uſual way, by the vagina.

SECTION II.

Of the Cæſarean Operation.

THIS operation may become neceſſary, as we have ſeen in the laſt ſection, by the brim of the pelvis being ſo narrow that it will not allow the child to paſs; and it may alſo become proper where the child has been forced into the cavity of the abdomen by a rupture in the uterus, as ſometimes happens from the uterus contracting with too much force before the os tincæ is ſufficiently dilated.

The Cæſarean Section may be performed, either with a view to ſave both the mother and child, when the child cannot be extracted in any other manner; to ſave the mother only when we know that the child is dead; or to ſave the child immediately after the death of the mother.

As there are few inſtances of the mother being ſaved by this operation, ſome have adviſed that it ſhould never be performed till after the death of the mother. I am clearly of opinion, that an operation attended with ſo much hazard, ſhould never be adviſed as long as there is the leaſt reaſon to hope that delivery may be effected in any other manner: but I alſo think, that it is the duty of every practitioner to propoſe it when this cannot be accompliſhed; for it is ſurely better to afford the ſmall chance to the mother that accrues from it, than to leave her with the certain proſpect of death; while by the ſame means we may be enabled to ſave the child, which otherwiſe would be deſtroyed. None will heſitate in adviſing it after the death of the mother, when the child is found to be living. The following is the method of performing it.

The patient ſhould be placed upon a table of the uſual height, and laid upon her back; her hands and legs being properly ſecured by aſſiſtants; her head ſhould be moderately elevated with pillows, and her thighs ſomewhat raiſed, in order to relax the abdominal muſcles. The operator ſtanding on one ſide of the table, is, with a common round-edged ſcalpel, to make an inciſion, ſix inches in length, through the ſkin and cellular ſubſtance, on one ſide of the abdomen: The cut ſhould commence two inches above the umbilicus on the outer edge of the rectus muſcle, and from thence ſhould be carried in a perpendicular direction ſix inches downwards. The uterus is now to be laid bare, by carrying the inciſion through the tendinous parts of the abdominal muſcles, and peritonæum; and this being done, an opening of the ſame length muſt be made in the uterus itſelf. The eaſieſt method of effecting this, is, to make a ſmall opening with the ſcalpel, ſufficient to admit the finger, to ſerve as a conductor to a probe-pointed biſtoury, with which the remaining part of the inciſion ſhould be finiſhed. I may alſo remark, that the biſtoury inſerted upon the finger, at an opening made for the purpoſe, affords the eaſieſt method of dividing the peritonæum and tendinous aponeuroſis of the abdominal muſcles.

If any large bloodveſſel is cut either in making the outward inciſion or in dividing the uterus, it ſhould be immediately tied with a ligature of a ſufficient length to hang out at the wound. The child muſt now be taken out; the placenta, and any effuſed blood that may have eſcaped during the operation, being alſo removed, and the inteſtines, if they have protruded, being replaced, the external opening ſhould be ſecured with three or four ſutures, in the manner I have adviſed in Chapter III. Sect. XII. § 3.

The wound being covered with a pledget of any emollient ointment, the abdomen ſhould be ſupported with ſeveral turns of a broad flannel roller; when the patient ſhould be carried to bed, and ſtrictly enjoined to avoid ſpeaking and every kind of exertion.

Various cauſes concur to render this a very dangerous operation: Of theſe, the extenſive expoſure of the abdominal viſcera, and hemorrhagies from the uterus, are the moſt material. Any protruſion, therefore, which occurs of the bowels, ſhould be immediately replaced, and no veſſel of any importance that may be cut in the diviſion of the uterus ſhould be left untied: This is not adviſed by writers upon this ſubject, but I ſee no harm that can enſue from it. If the ligatures are applied with the tenaculum, they will ſoon ſeparate; and by hanging out at the external wound, they may at any time be pulled away. It may be remarked, that it is internal hemorrhagies only that we have to dread, I mean ſuch as occur from the veſſels of the uterus: For, by carrying the inciſion on the outer edge of the rectus muſcle, we avoid the epigaſtric artery, the only veſſel of importance that runs any riſk of being hurt in the diviſion of the teguments and muſcles.

In order to avoid the riſk of hemorrhagies from the uterus, ſome have adviſed the inciſion never to be made at that part where the placenta adheres; while, by others, we are directed to make the opening into the uterus exactly in a longitudinal direction, by which we are told that the principal veſſels with which it is ſupplied will moſt readily be avoided. No advantage, however, is derived from this: For the inciſion in the uterus muſt correſpond exactly with the external inciſion; which cannot with propriety be made in any other direction than the one I have mentioned. Beſides, it would often be impoſſible to diſtinguiſh the part at which the placenta adheres; nor is there much ground to ſuppoſe that the hemorrhagy from the uterus depends ſo much upon the direction as on the extent of the inciſion; and it ought not to be leſs than ſix inches in length, as the child could not be extracted with freedom at a ſmaller opening. It is ſcarcely neceſſary to remark, that the child and placenta ſhould be removed as ſoon after the inciſion is made in the uterus as poſſible. It is thus allowed to contract, which it does inſtantaneouſly with great force; by which the hemorrhagy is more readily ſtopped than by any means that we could employ for it.

By others, we are adviſed to leave a large opening at the under part of the external inciſion, in order to give vent to any effuſion of blood that may happen. No advantage, however, is gained by this, as the inciſion in the uterus, although oppoſite to the external opening at firſt, very ſoon falls beneath it when it contracts; by which any blood that is diſcharged falls into the bottom of the abdomen where it coagulates, and thus cannot be diſcharged at the wound. And as it is of importance to prevent the air as much as poſſible from finding acceſs to the abdomen, the external cut ſhould be quickly and entirely ſhut, by as many ſutures as the length of it requires. The moſt effectual method with which I am acquainted of preventing hemorrhagies is, the tying of any large veſſels in the manner I have mentioned; keeping the patient cool and free from pain, by regulating the air of the apartment to a proper temperature, and adminiſtering opiates; and by preventing, as I have obſerved above, every kind of bodily exertion.

SECTION III.

Of the Diviſion of the Symphyſis Pubis.

IT has been long known, that the bones of the female pelvis are connected in ſuch a manner, that during the latter months of pregnancy, and eſpecially during labour, they are ſeparated in ſome degree from each other; by which the paſſage of the child is rendered much eaſier than it otherwiſe would be. It was a knowledge of this fact, and the great danger attending the Cæſarean operation, that firſt ſuggeſted the idea of dividing the bones of the pubis at their junction with each other in caſes of narrow pelvis. It was propoſed upwards of two hundred years ago, by a French ſurgeon of the name of Pineau; but Mr Sigault of Paris was the firſt who had the merit of putting it in practice, in the year 1777.

The operation is eaſily performed. The patient muſt be laid upon her back on a table of a convenient height; the pelvis ſhould be elevated with two or three pillows put beneath it, and the legs and arms ſecured by aſſiſtants. When in this ſituation, the bladder muſt be emptied by the introduction of a catheter, which ſhould be retained in the urethra by one of the aſſiſtants till the diviſion of the bones is completed.

After ſhaving the pubis, the operator, ſtanding on one ſide of the patient, ſhould, with a longitudinal inciſion, divide the ſkin and cellular ſubſtance covering the pubes at their ſymphyſis: The cut ought to commence at the upper edge of theſe bones, and be continued nearly, but not entirely, along their whole breadth: On the bones being laid bare, the cartilage by which they are joined muſt be ſlowly and cautiouſly divided; and as it is by no means hard, it is eaſily done. Both the teguments and cartilage, may be divided with a firm round-edged ſcalpel of the common form, which is the only inſtrument except the catheter that is neceſſary in this operation. The intention of the catheter is, to point out the courſe of the urethra to the operator; for it lies ſo contiguous to the pubes at their ſymphyſis, as to be in great danger of being cut, if this precaution is neglected: even the bladder itſelf might be injured, were the diviſion of the cartilage not conducted with caution: but with due attention to theſe points, and avoiding the total diviſion of the ſoft parts at the under edge of the bones, all riſk of hurting either the bladder or urethra may be prevented.

On the diviſion of the cartilage being completed, the bones recede conſiderably from each other. To prevent any conſequences that might enſue from their ſeparating forcibly and ſuddenly, the aſſiſtants who have the charge of the thighs ſhould be deſired to ſupport them, particularly towards the end of the operation; and if a ſufficient opening is not gained in this manner, the thighs may afterwards be ſlowly and gradually ſeparated.

The child is now to be delivered in the uſual way by the vagina; and this being effected, and the placenta removed, the bones ſhould be immediately put together, and retained as exactly as poſſible in their ſituation, by the proper application of a flannel or cotton roller round the pelvis and thighs; at the ſame time that the patient ſhould be deſired to remain as much as poſſible in one poſture. The ſore does not require any particular attention: In general, it heals eaſily with light mild dreſſings; and for the moſt part the union of the bones is completed in the courſe of the fifth or ſixth week. The patient, however, ſhould not be allowed to walk, or to put the body into any poſture that might alter the ſituation of the bones, till nine or ten weeks have elapſed.

The chief objection that occurs to this operation is, the ſmall ſpace that is gained by it in that part of the pelvis where ſpace is moſt required. By ſeparating the oſſa pubis at their ſymphyſis, theſe bones do indeed recede to a conſiderable diſtance from each other: for the moſt part the ſeparation that takes place will be at leaſt two inches in length; but this does not increaſe the narrow diameter of the pelvis, that is, the bones of the pubis will ſtill remain at nearly the ſame diſtance from the os ſacrum as before the operation; and in almoſt every inſtance of difficult labour from malconformation of the pelvis, we find that it proceeds entirely from the oſſa pubis and os ſacrum being too near each other. It may often happen, however, that the head of the child may be ſo ſituated, that even this ſeparation of the oſſa pubis alone may allow it to paſs, when otherwiſe it would have remained entirely above the brim of the pelvis; and as we do not find that the operation is productive of much danger, for in different inſtances it has been done more than once on the ſame perſon, it ſhould always be adviſed, when we are convinced that the pelvis is ſo narrow that the child cannot poſſibly paſs through it. It ſhould always be adviſed in preference to the Cæſarean operation.

If farther experience ſhall ſhow, that in all caſes of narrow pelvis, the child may be delivered in this manner, it ſhould even be preferred to the mode of delivering with the crotchet, which is undoubtedly one of the moſt barbarous operations in ſurgery; for while the very intention of the operation is to deſtroy the child, it often tears and mangles the mother ſo much that ſhe never recovers from the effects of it.

CHAPTER L.

Of OPENING DEAD BODIES.

WITH a view to diſcover the ſeat and cauſes of diſeaſes, and at the inſtance of the civil magiſtrate in caſes of violent death, ſurgeons are employed to open dead bodies; and to do this with accuracy, every preternatural appearance ſhould be committed to paper. After noting any external marks of diſeaſe, we proceed to examine the ſtate of the different cavities and of their contents. When the diſeaſe has been evidently ſeated in one cavity, we do not open the others; but when they are all to be examined, it is proper to begin with the head.

The body being placed upon a table of a convenient height, and the head firmly fixed by an aſſiſtant, an inciſion ſhould be made from ear to ear acroſs the parietal bones. The ſcalp is now to be diſſected from the parts beneath; and one-half being turned backward and the other over the face, a common amputating ſaw is uſed for dividing the cranium: The diviſion may be begun on the os frontis immediately above the frontal ſinuſes, and ſhould afterwards be continued backward through the parietal bones and os occipitis. The upper part of the ſkull is now to be raiſed with a levator; by which the dura mater may be freely examined; and if we wiſh to go to the depth of the ventricles only, this may be done without removing the brain. But when our object is to examine the ſtate of the brain and cerebellum, they muſt both be removed and examined at leiſure. This being done, and all the extravaſated blood taken off with a ſponge, the brain and cerebellum muſt be replaced with the ſkull-cap above them. The two portions of ſcalp are now to be drawn over the whole, and ſecured in their ſituation by ſewing the edges of the cut together from one end to the other, either with the glover's ſtitch, or in any other way which the operator may prefer. For this purpoſe narrow tape is uſually employed, and a large curved needle with a triangular point.

The cavities of the thorax and abdomen are moſt effectually expoſed in the following manner: Let an inciſion be made through the common teguments from the top of the ſternum to the umbilicus, and let it be continued on each ſide through the abdominal muſcles, from the umbilicus in an oblique direction down to the top of the os ileum: The teguments and muſcles muſt now be diſſected from the thorax, till all the cartilages which connect the ſternum and ribs are freely laid bare; and being drawn backward, the cartilages muſt be divided with a ſtrong knife as near as poſſible to the ribs; when the diaphragm being ſeparated beneath, the under part of the ſternum and cartilages connected with it, being raiſed and turned upward, the ſternum muſt either be ſeparated from the clavicles, or cut acroſs near to the upper end of it. In this manner the contents of the thorax and abdomen are brought into view, when moſt of them may be examined without being removed; but when more accuracy is required than this admits of, the whole ſhould be taken out: Or, when a partial examination is only required, that portion of them only may be removed which we mean to inſpect.

To prevent the inconvenience reſulting from the infuſion of much blood and excrement, two ſtrong ligatures ſhould be paſſed at the diſtance of an inch from each other round the under part of the alimentary canal and large contiguous bloodveſſels, and round the trachea, œſophagus, and large bloodveſſels of the neck. The parts between the two ligatures both above and below being divided, the whole viſcera of both the cavities may then be eaſily removed, by diſſecting them from the contiguous parts, and raiſing them up as we go along.

The neceſſary examination being finiſhed, the effuſed blood all waſhed off with a ſponge, and the viſcera replaced, the teguments muſt be drawn over them, and ſtitched together with as much neatneſs as poſſible.

In opening bodies that have died of any diſeaſe, the operator ſhould be as cautious as poſſible in avoiding cuts or ſcratches of his fingers and hands: Various inſtances have occurred of much diſtreſs being induced; and in ſome caſes even death has enſued, from inattention to this circumſtance.

CHAPTER LI.

Of EMBALMING.

IN former times, embalming was practiſed with more care and attention than it is now. This was a neceſſary conſequence of the deſire which then prevailed, of preſerving dead bodies for ages. At preſent it is ſeldom employed, except for the purpoſe of preventing bodies from putrefying, during the ſhort ſpace which elapſes between the death and burial of the perſon; and not even with this view, if the corpſe be not to be kept longer than is uſually done in private life.

The following is the preſent method of embalming. The brain, and all the viſcera of the thorax and abdomen, being removed in the manner I mentioned in the laſt Chapter, they are all, excepting the heart, put into a leaden box with a conſiderable quantity of an aromatic antiſeptic powder, prepared with myrrh, frankincenſe, cloves, the leaves of lavender, roſemary, mint, ſage, and other ſimilar articles; and to theſe are added a proportion of any odoriferous oils. The blood being removed from the different cavities, and the heart replaced, they are all filled with the ſame kind of powder, with a due proportion of odoriferous oils or ſpirits, and the parts afterwards ſewed up in the manner I have already adviſed. By ſome, too, the mouth and noſtrils are ſtuffed with theſe powders and oils; and inciſions are made into all the fleſhy parts of the body, which are alſo ſtuffed with them, and afterwards ſewed up: But there is no neceſſity for this, unleſs the body is to be kept for a great length of time, or to be carried to a conſiderable diſtance. In which caſe, it is uſual, after ſtuffing the inciſions in the manner I have mentioned, to roll all the extremities, as well as the trunk of the body, firmly and ſeparately up with bandages, and to cover the whole with varniſh.

The body is now to be laid upon a cerecloth of a ſufficient ſize, which muſt be applied with as much neatneſs as poſſible to the head and every part of the body, and either firmly ſecured by ſewing, or with tapes tied at proper diſtances. The cerecloth is made of linen dipped in a compoſition of wax, oil, and reſin; which ſhould be of ſuch a conſiſtence as to be ſufficiently pliable, without being ſo ſoft as to ſtick to the fingers of thoſe who apply it: It may be coloured with verdegris, red lead, or any other article, according to the fancy of the operator. When two cerecloths are applied, one above another, they are uſually made of different colours.

The cerecloth being put on, it was formerly the cuſtom to employ a painter to colour the face; but this is now very commonly omitted: The dreſs intended for the corpſe is immediately put on; and the body is either laid in the coffin, or allowed to be expoſed, according to circumſtances.

CHAPTER LII.

Of BANDAGES.

BANDAGES are employed for various purpoſes in Surgery; for the retention of dreſſings; for ſtopping hemorrhagies; for removing deformities; and for effecting the union of divided parts.

As a proper application of bandages is an object of much importance, it is a branch of the art which authors have not neglected: Many treatiſes have been publiſhed upon it; but unfortunately it cannot be taught by deſcription: Experience alone can give an adequate idea of it; nor is it poſſible to acquire it but by much manual practice. Hence, in the ſtudy of this part of ſurgery, more advantage is to be gained by practiſing upon a block, than by reading the moſt elaborate diſſertations. My only intention, therefore, at preſent is, to offer a few general obſervations upon bandages.

1. Bandages ſhould be formed of ſuch materials as are ſufficiently firm for effecting the purpoſe for which they are intended, at the ſame time that they may ſit with eaſe upon the parts to which they are applied.

In ſome caſes a degree of firmneſs is required, which cannot be obtained from materials of a ſoft texture: Of this we have examples in the moſt part of truſſes for herniæ, as well as in every bandage requiring much elaſticity: But for the moſt part bandages are made of linen, cotton, or flannel. Till of late, linen was univerſally uſed for this purpoſe; but later experience has ſhown, that cotton and flannel are preferable. They abſorb moiſture more readily, whether it be produced by ſweat, or as the ordinary diſcharge of wounds or ſores, at the ſame time that they are better calculated by their elaſticity for yielding to the ſwelling which often takes place in luxations, fractures, and other injuries for which bandages are employed. Flannel was firſt uſed for this purpoſe in the Royal Infirmary here, about forty years ago, by Mr James Rae of this place; and ſince that period the practice has been generally adopted. The objection made to the uſe of flannel for bandages, by ſome practitioners, of its not being ſo cleanly as linen, is frivolous: Neither of them will be cleanly if not frequently changed, while either of them will be ſufficiently ſo, if this point is attended to.

2. Bandages ſhould be applied of a degree of tightneſs ſufficient for anſwering the purpoſe for which they are intended, without incurring any riſk of impeding the circulation, or doing harm in any other manner. No advantage will acrue from them, if they be not ſufficiently tight

to ſupport the parts affected; while ſwelling, inflammation, and even gangrene, will occur if they are too tightly applied.

3. Every bandage ſhould be applied in ſuch a manner, that it may be as eaſily looſened, and the parts examined with as much accuracy as poſſible. Thus in fractures of the thigh and leg, where the limb cannot with propriety be frequently raiſed, we now prefer univerſally the bandage with twelve or eighteen tails to the common roller. The former can be undone and fixed at pleaſure without moving the limb, while a roller can neither be applied nor removed without raiſing every part of the limb to a conſiderable height.

4. Bandages ſhould always be laid aſide as ſoon as the purpoſe for which they are intended is accompliſhed. This being obtained, no advantage can accrue from them, and they often do harm by impeding the growth of the parts upon which they are applied.

5. I have found it neceſſary in the courſe of this work to mention bandages

for many parts of the body. In ſpeaking farther of bandages for particular parts, I ſhall begin with the head, and proceed downwards to the trunk of the body and extremities.

One of the beſt bandages for all the upper and back parts of the head, for the forehead, ears, and temples, is a night-cap, with one band to tie it before, and another beneath the chin, as is repreſented in Plate CVII. fig. 1. The Couvre-chef of the French, repreſented in fig. 2. is moſt frequently uſed for theſe parts; but it can neither be applied with ſuch firmneſs or neatneſs as the night-cap.

For the purpoſe of making compreſſion on any particular part of the head, the Radiated Bandage, as it is termed, may be employed, as is repreſented in the ſame Plate, fig. 3. It may alſo be uſed for compreſſing the temporal artery: But for this purpoſe, the ſpring-bandage repreſented in Plate V. fig. 2. anſwers better.

In longitudinal cuts of the head, the Uniting Bandage, as it is termed, is uſed with advantage. It is formed of a long roller with two heads, with a ſlit or opening in the middle, as is repreſented in Plate CVIII. fig. 3. The ſides of the cut being drawn neatly together, and covered with a pledget of any ſimple ointment, the cure is to be effected by means of this bandage, applied in the manner repreſented in fig. 6. of the ſame Plate. In cuts of this deſcription, their edges may ſometimes be retained together with ſufficient exactneſs by this bandage; and, when this can be done, it ſhould always be preferred to the mode of doing it with ſutures.

When it is neceſſary to retain dreſſings upon the eyes, it has uſually been done by placing a compreſs over them and retaining it by ſeveral turns of a long roller, ſuch as is repreſented in Plate CVIII. fig. 1. This bandage, when employed for one eye, is the Monoculus of authors, and it is termed Binoculus when applied to both eyes. But as a roller paſſed round the head is apt to ſlip, even when applied in the moſt exact manner, the couvre-chef in Plate CVII. fig. 2. or the night-cap in the ſame Plate, fig. 1. ſhould be preferred.

In fractures and cuts of the noſe, the dreſſings are beſt retained by a proper application of the uniting bandage in Plate CVIII. fig. 3. and a proper application of the ſame bandage anſwers beſt in longitudinal cuts of either of the lips.

In fractures of the lower jaw, we employ a four-headed roller, ſuch as is repreſented in Plate CVIII. fig. 4. The ſpace left entire between the four heads is applied to the chin, the hole in the centre being meant to receive the apex of chin. The two ſuperior heads are then carried backwards; and being made to paſs each other at the occiput, they are afterwards brought forward over the os frontis: They may either be fixed there, or again reflected back, and fixed with pins on the ſides or back-parts of the head. The two under heads of the roller being reflected over the chin, are then to be turned upwards, and either tied or pinned on the top of the head; or before fixing them, they may be made to paſs each other two or three times. Various other bandages are deſcribed by authors for the head; but thoſe I have mentioned, with a proper application of the common roller, Plate CVIII. fig. 1. for particular purpoſes, are all that can be ever required.

6. In Plate LVI. fig. 1. an inſtrument is delineated for one of the moſt material operations upon the neck, Bronchotomy; and in Plate LIV. fig. 1. another is repreſented for the wry neck: A common roller may be made to anſwer every other purpoſe that can be required of a bandage in any part of the neck.

7. A variety of bandages are uſed for the ſhoulders and contiguous parts, particularly for fractures of the ſcapula, and fractures and luxations of the clavicle. In fractures of the ſcapula, a proper application of a long roller may, in moſt inſtances, prove uſeful; but in Chapter XXXIX. Sect. V. I have ſhown, that no utility is derived from bandages in fractures of the clavicles: They cannot be applied with

ſuch tightneſs as to compreſs the fractured bone without impeding reſpiration; and beſides, we do not find that they are neceſſary, when the arm of the affected ſide is properly ſupported by the ſling, Plate XCIX. fig. 2.

The moſt uſeful of all bandages for the thorax and abdomen, at leaſt for the retention of dreſſings on any of theſe parts, is that which we uſually term the Napkin and Scapulary, repreſented in Plate CIX. fig. 1. That part of it which goes round the body A, is termed the Napkin. When applied for making preſſure upon a fractured rib, it ſhould be in the form of a roller, and ſhould paſs two or three times round the body: when only uſed for retaining dreſſings, it ſhould not go more than once round: It ſhould be ſix or ſeven inches broad for an adult; and ſecured by pieces of tape, tying it at each end, inſtead of pins. The Scapulary B C, conſiſts of a ſlip of linen, cotton or flannel, about three inches broad, and of a length ſufficient to reach from the upper part of the napkin behind, to paſs over the ſhoulders and be pinned to it before: It is ſometimes made with a hole in the centre for paſſing over the head; but it anſwers better to divide the anterior end of it by a longitudinal ſlit into two, and, in applying it, to make one of theſe ſlips paſs on each ſide of the neck.

This bandage anſwers the purpoſe better than any other, for making preſſure on the parts at which the viſcera protrude, in umbilical and ventral herniæ. As in ſuch caſes it is a point of much importance to have the bandage firmly fixed, we not only employ the ſcapulary for preventing it from ſlipping down, but a ſtrap connected with it behind is paſſed between the thighs, and pinned to it before, to prevent it from ſlipping up.

In Plate LXII. fig. 2. a bandage is repreſented for compreſſing the abdomen in the operation of tapping; and in Plate LXIV. different bandages are delineated, or Truſſes, as they are termed, for the retention of the protruded viſcera in caſes of hernia.

9. As it is of much importance in various diſeaſes, as well as in ſeveral operations, to have the ſcrotum properly ſupported, I have delineated ſome bandages for this purpoſe in Plate CX. The beſt bandage for the penis is a pouch, or bag of linen or cotton, to be fixed by a roller, or two pieces of tape paſſed round the body.

The T-bandage, as it is commonly termed, Plate CIX. figures 3. and 4. is uſually employed for the retention of dreſſings about the anus and perineum, as well as for ſome diſorders of the ſcrotum; but in the laſt, one or other of the ſuſpenſory bandages, repreſented in Plate CX. will for the moſt part be found preferable.

10. In compound fractures of the arm, fore-arm, or hand, where motion of the limb would prove hurtful, the twelve or eighteen-tailed bandage is equally proper as in ſimilar affections of the lower extremities; but in ſimple fractures, as well as in almoſt every other affection of theſe

parts, we prefer a proper application of the rolier.

11. I adviſed the uniting bandage for longitudinal cuts in the head; it anſwers equally well in wounds of a ſimilar nature in every part of the extremities, as is repreſented in Plate CVIII. fig. 6.

END OF VOLUME SEVENTH.

PLATE LXXXVIII.

Fig. 1.

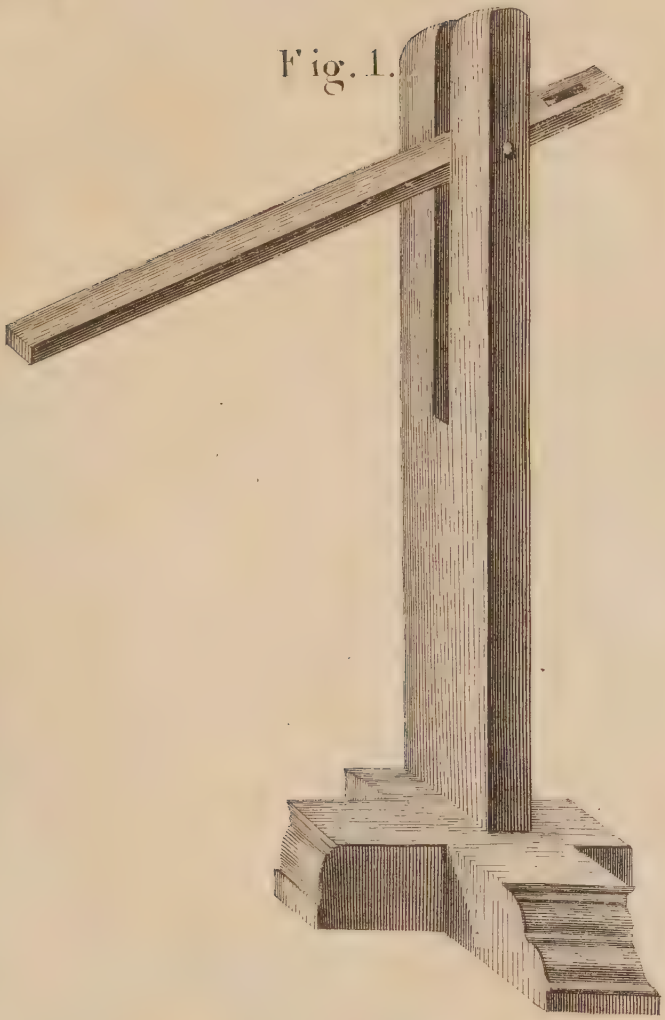


Fig. 2.

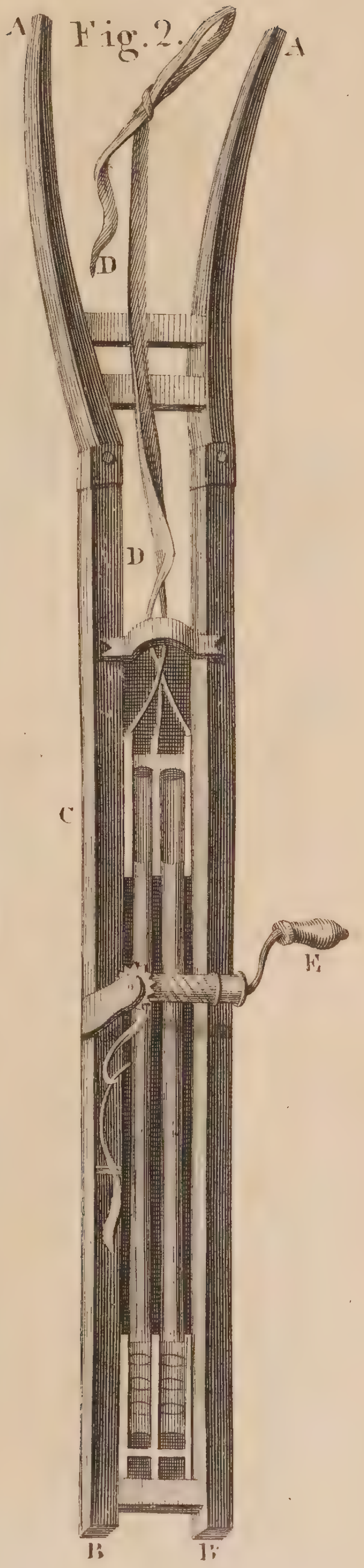
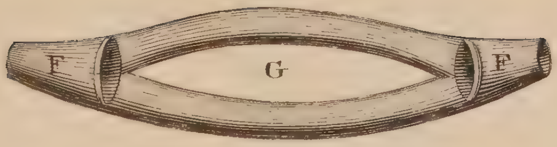


Fig. 3.



H. Lizars Sculp.

PLATE LXXXIX.

Fig. 1.

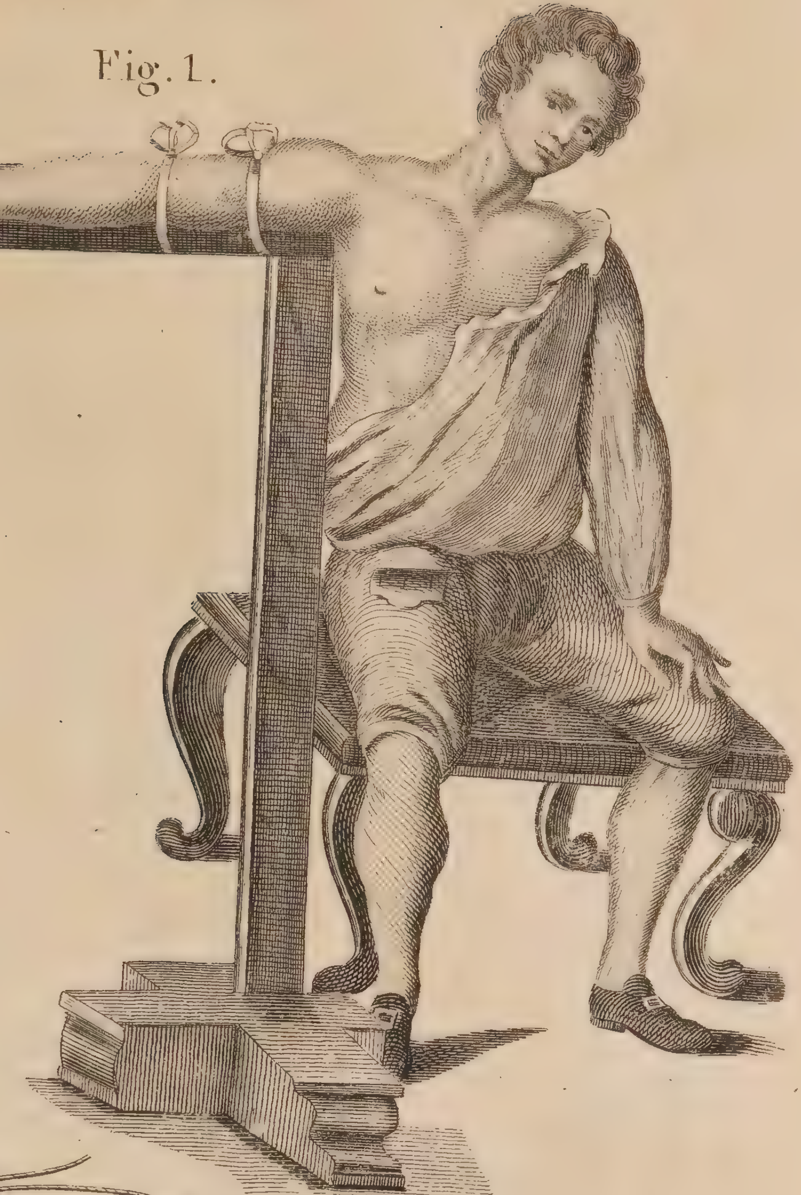


Fig. 2.

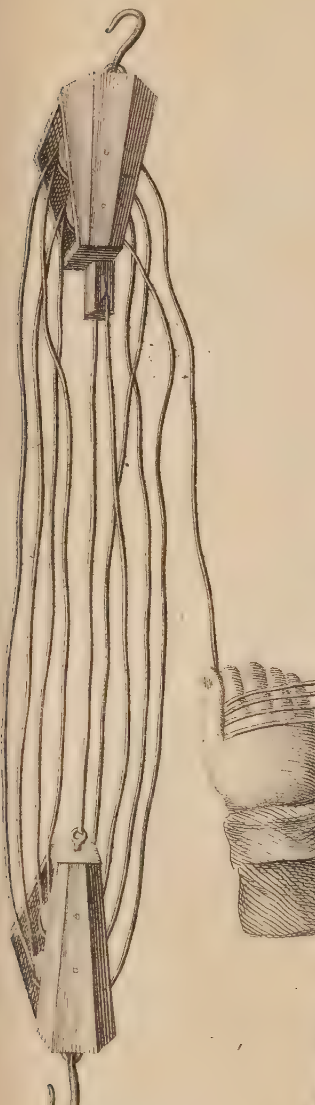
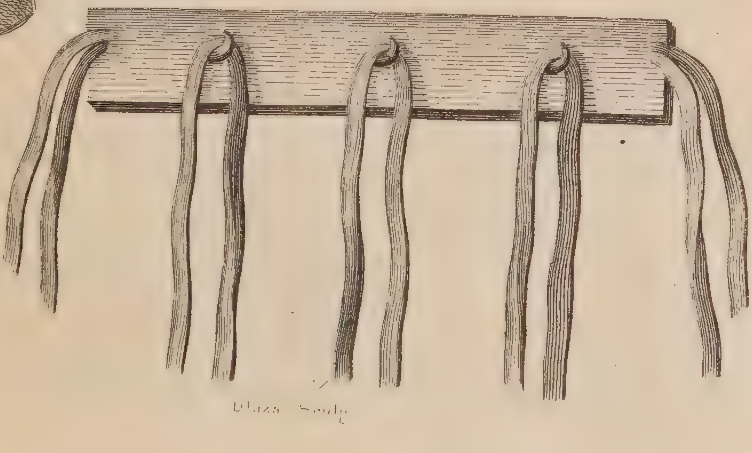


Fig. 3.



Blaza Sculp

PLATE XC.

Fig. 1.

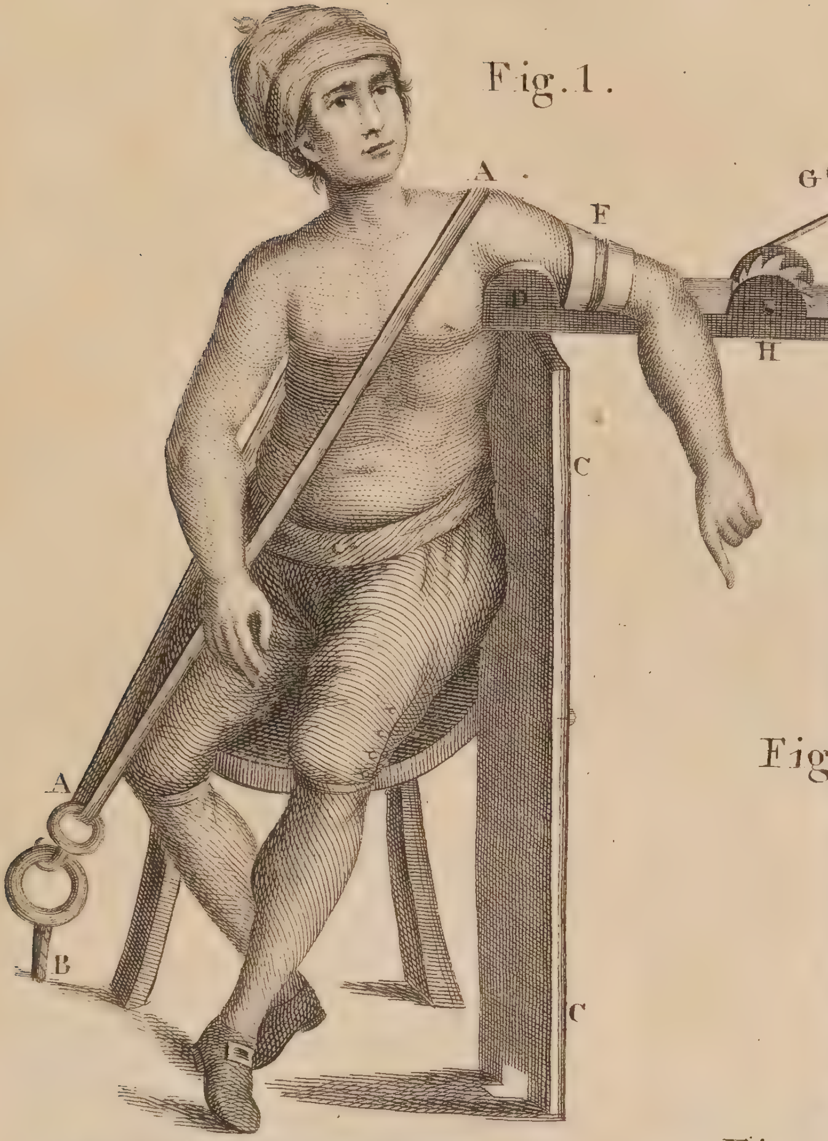


Fig. 2.

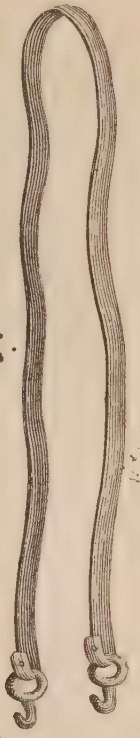


Fig. 5.

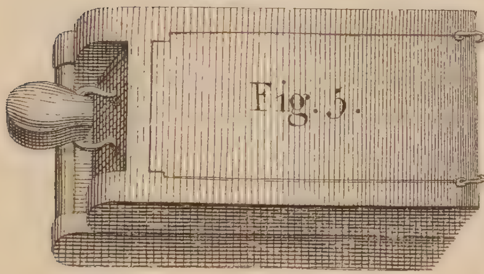


Fig. 3.

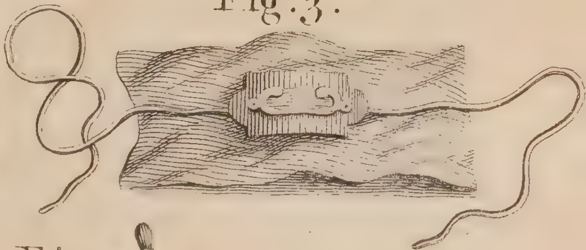
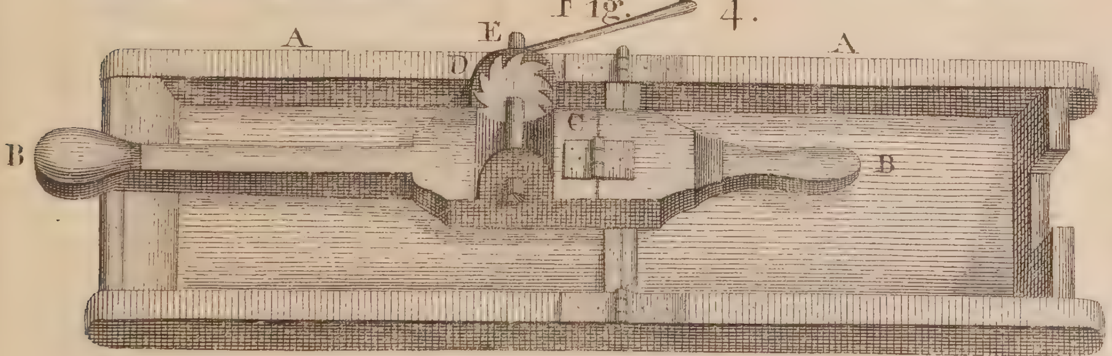


Fig. 4.



D.Lizars Sculp.

PLATE XCI.

Fig. 1.

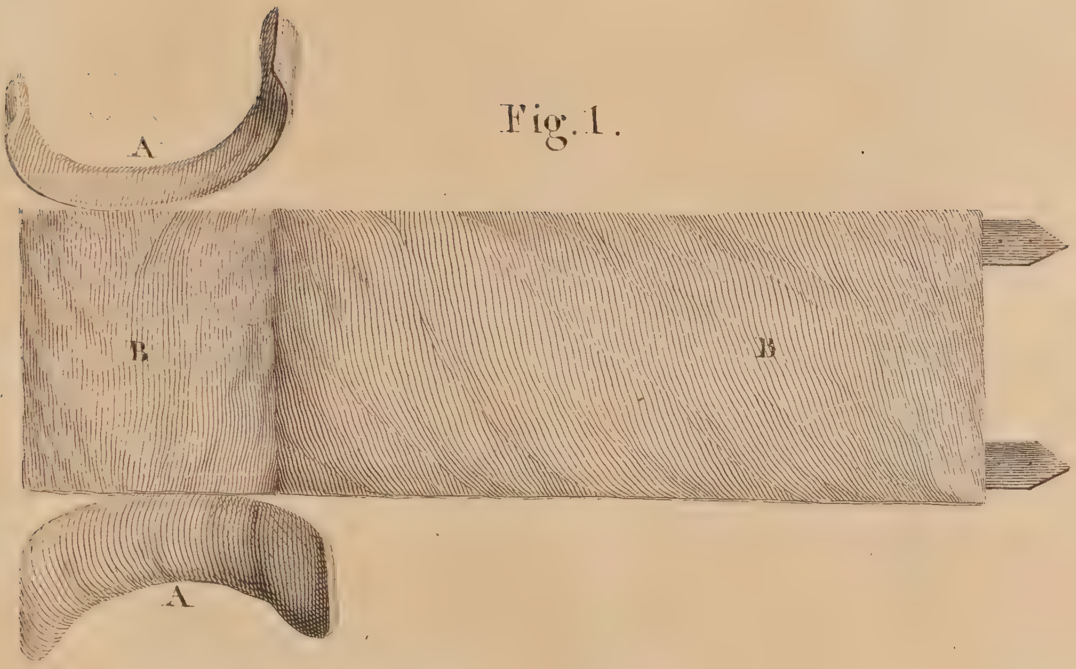


Fig. 2.

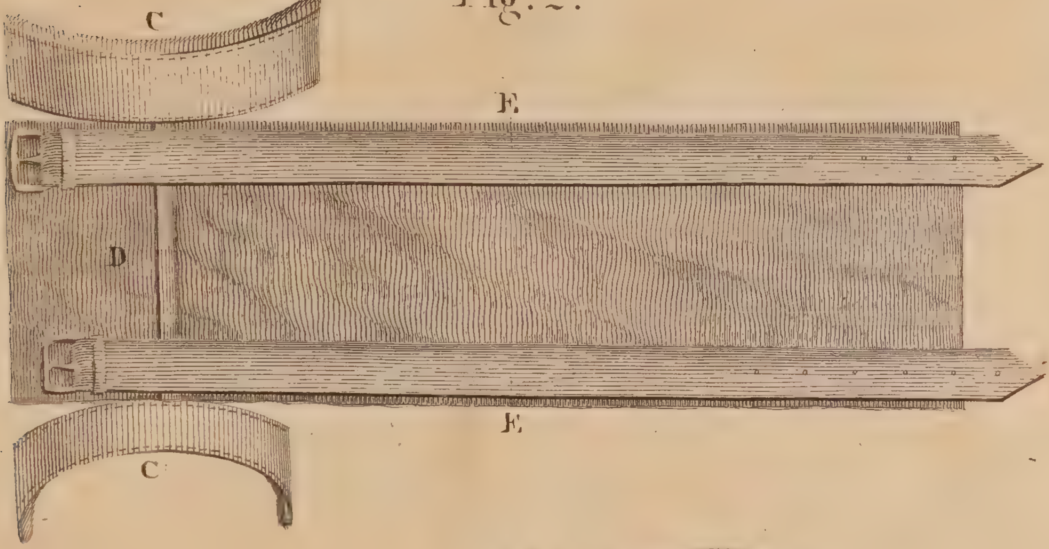
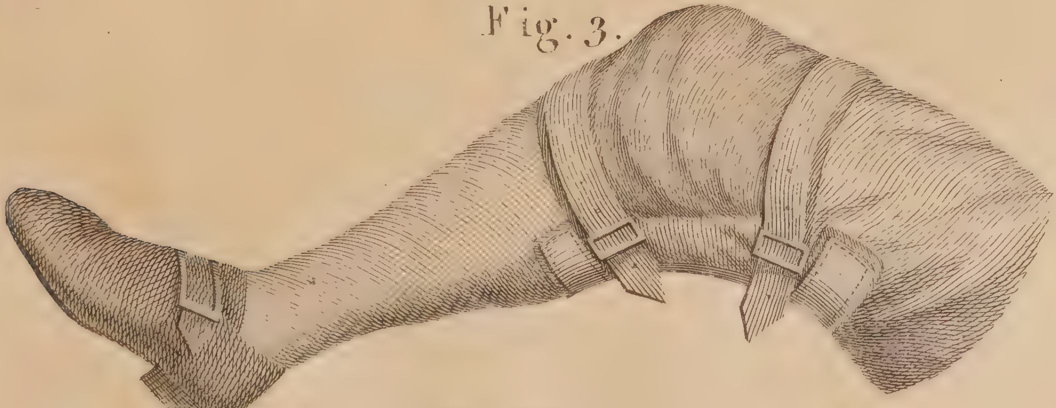
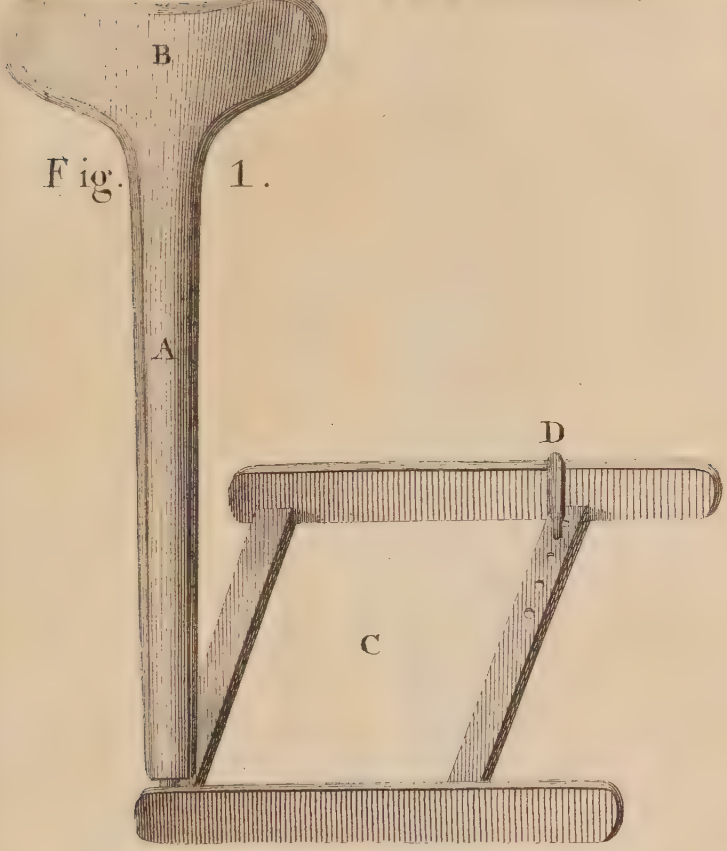


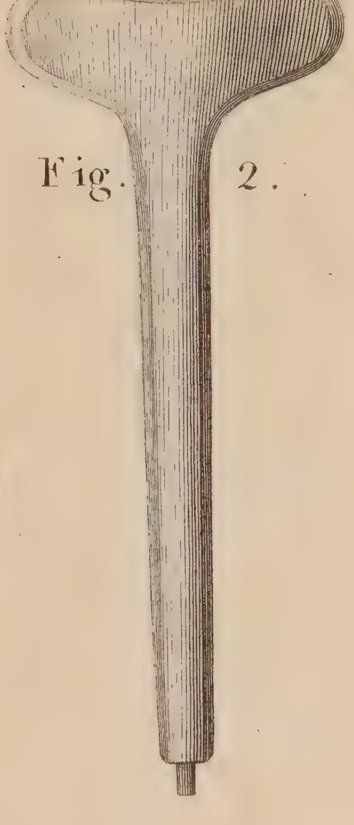
Fig. 3.

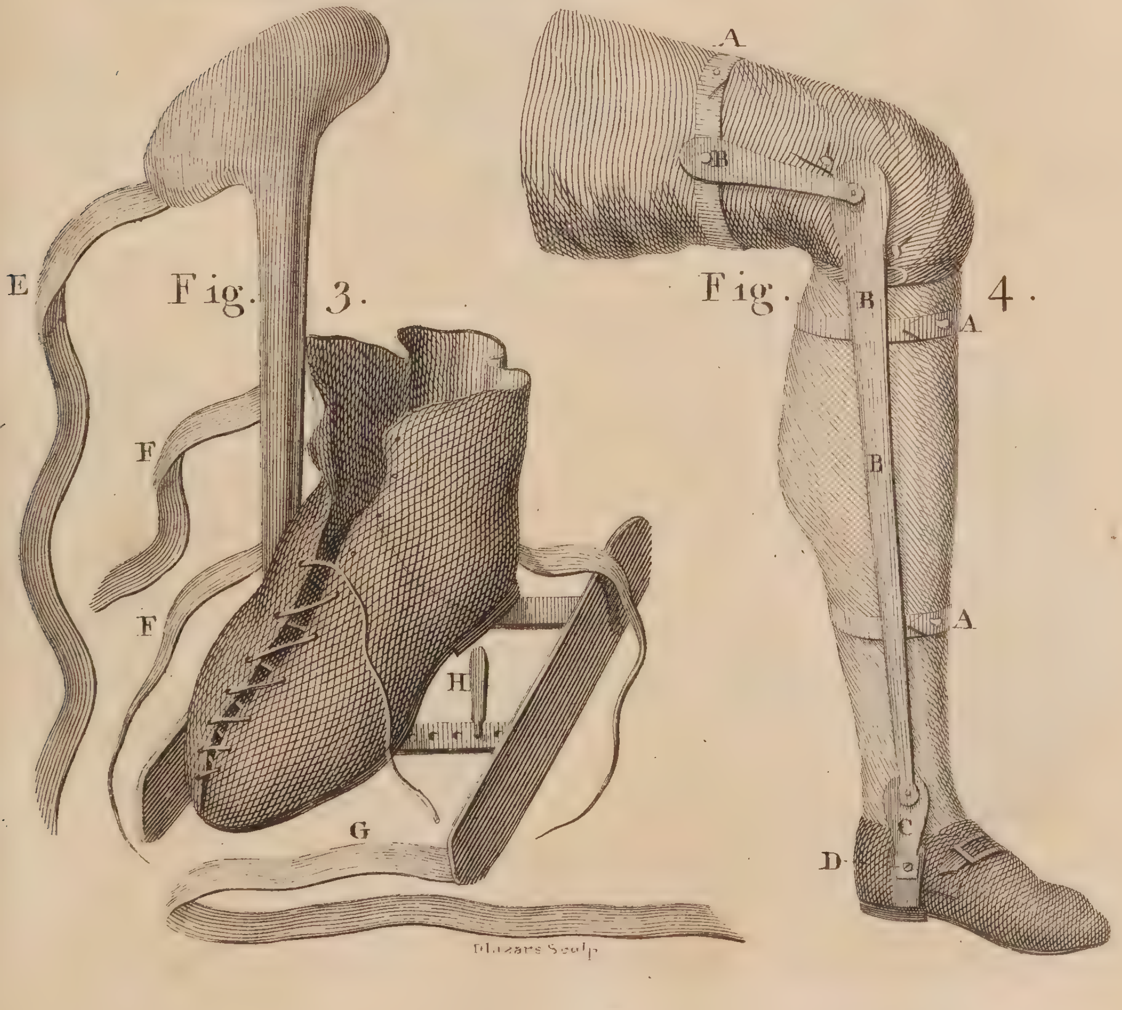


Mazars Sculp.

PLATE XCII.







Blazars Sculp

PLATE XCIII.

Fig. 1.

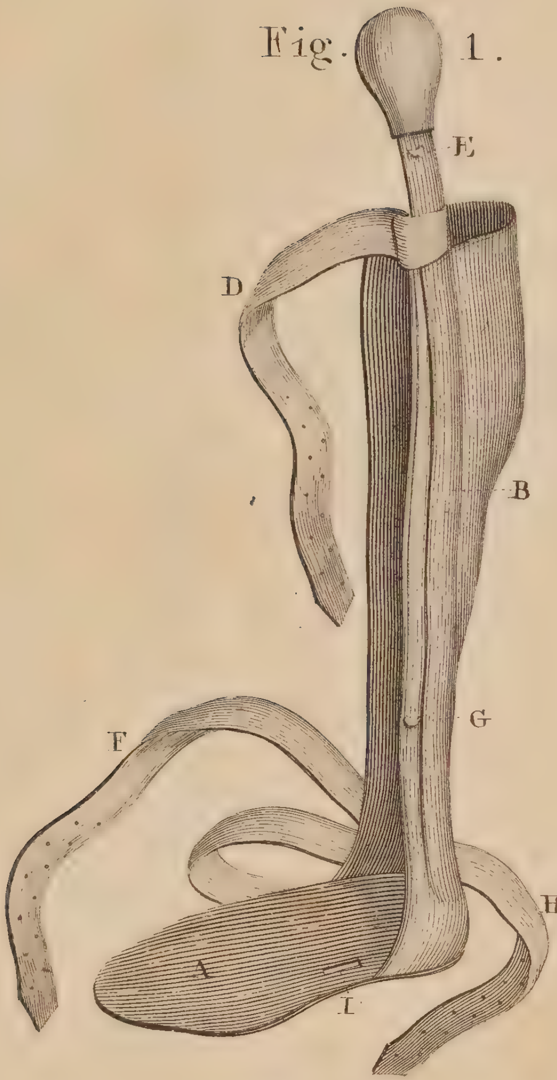


Fig. 2.

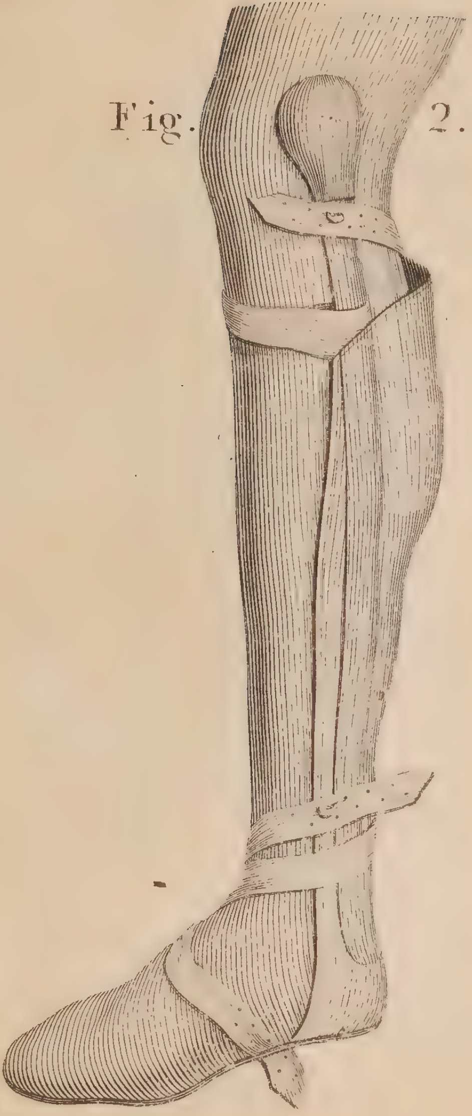


Fig. 3.

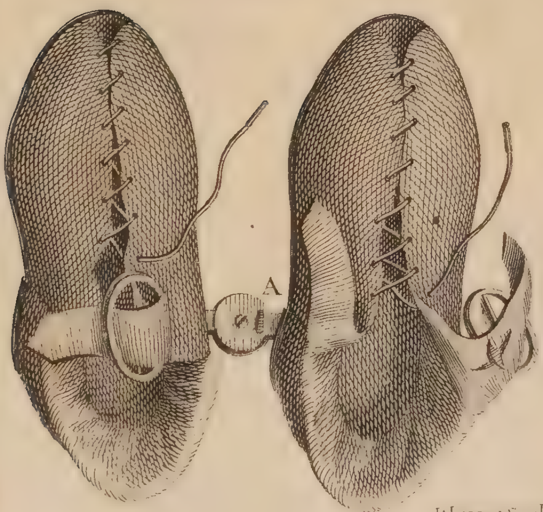


Fig. 5.

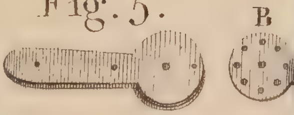
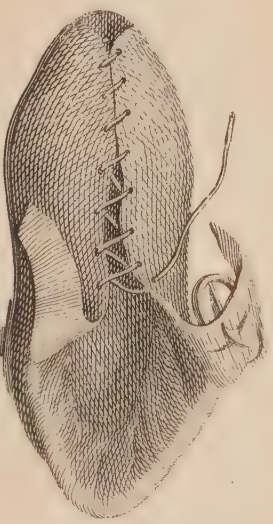


Fig. 4.



H.Lizars Sculp

PLATE XCIV.

Fig. 1.

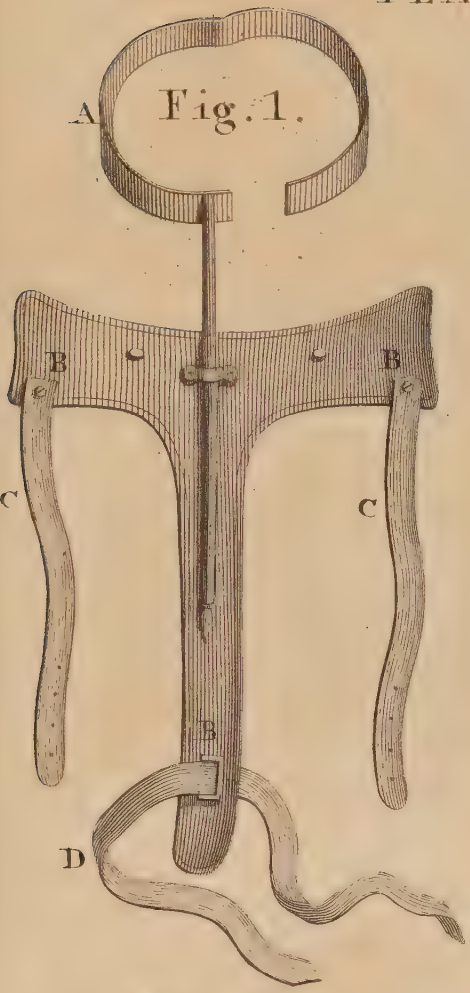


Fig. 2.

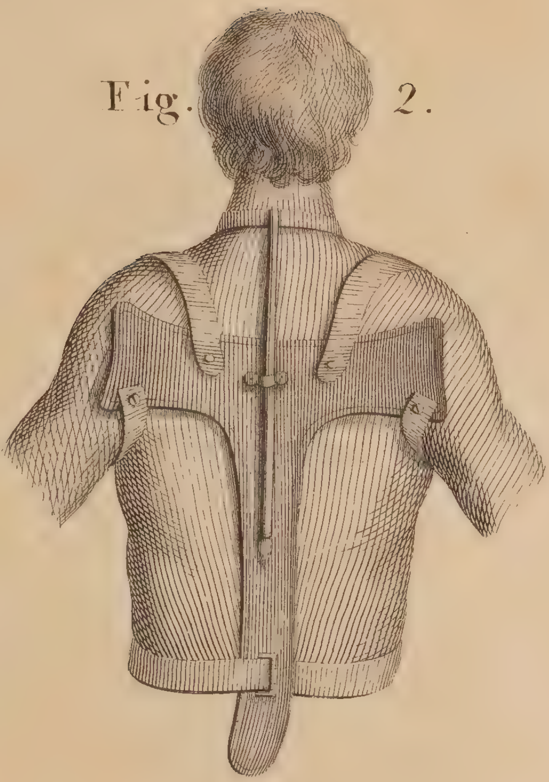


Fig. 3.

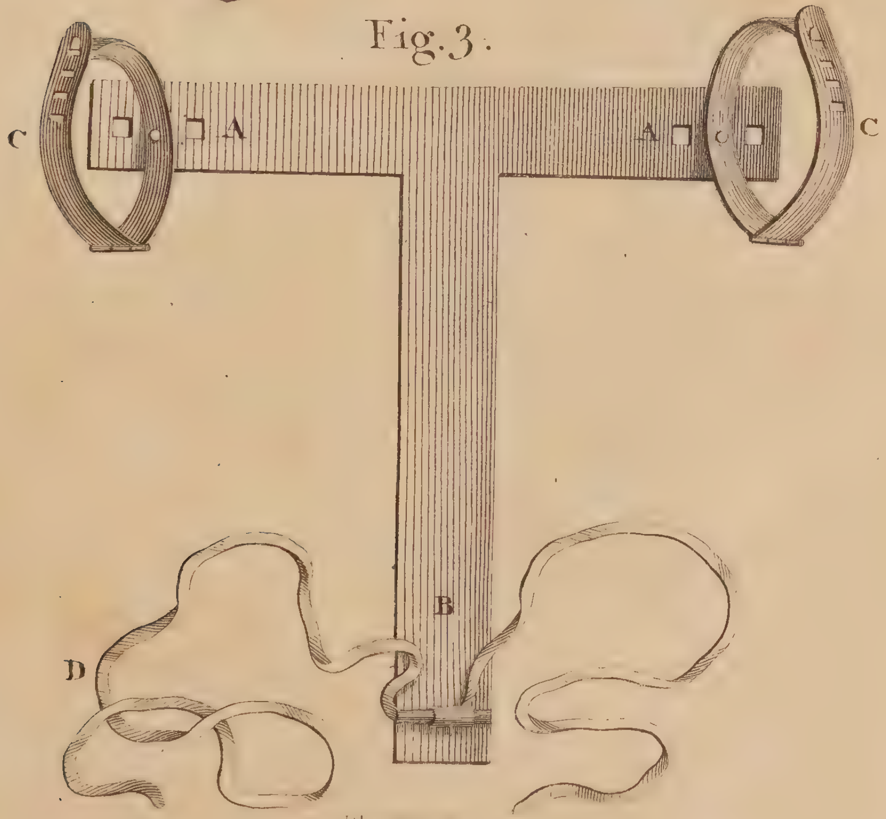
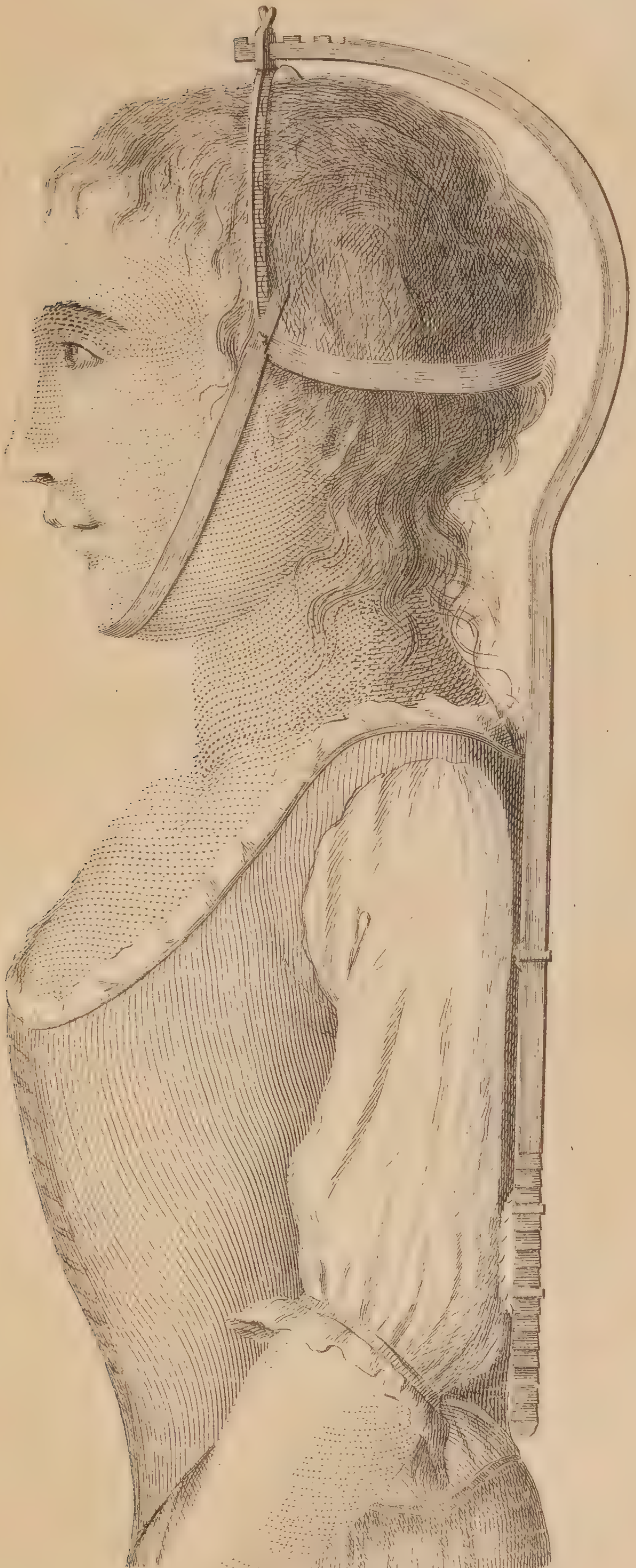
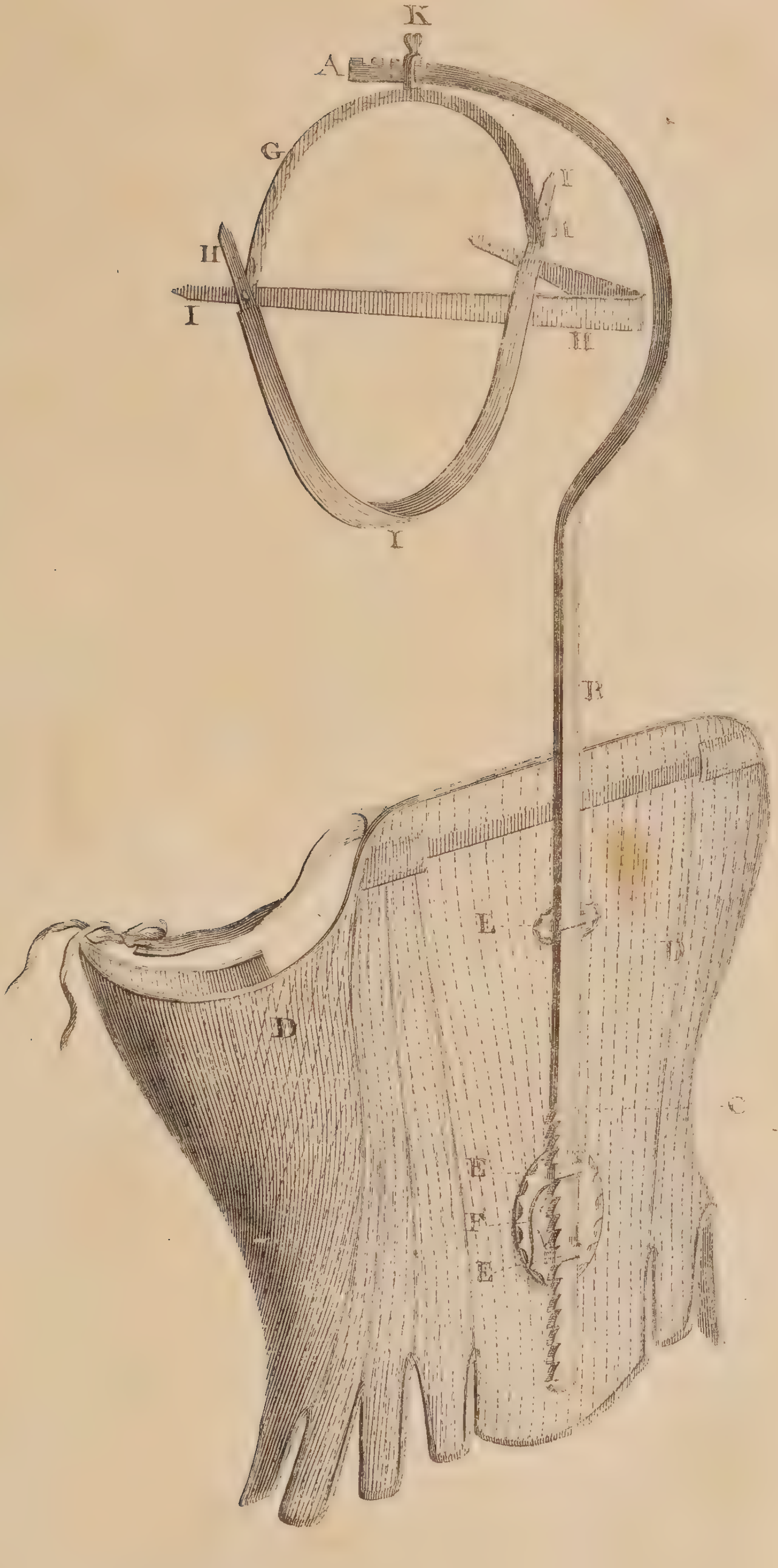


PLATE XCV.



D.Lizars Sculp

PLATE XCVI.



J. Lizars sculp.

PLATE XCVII.

Fig. 1.

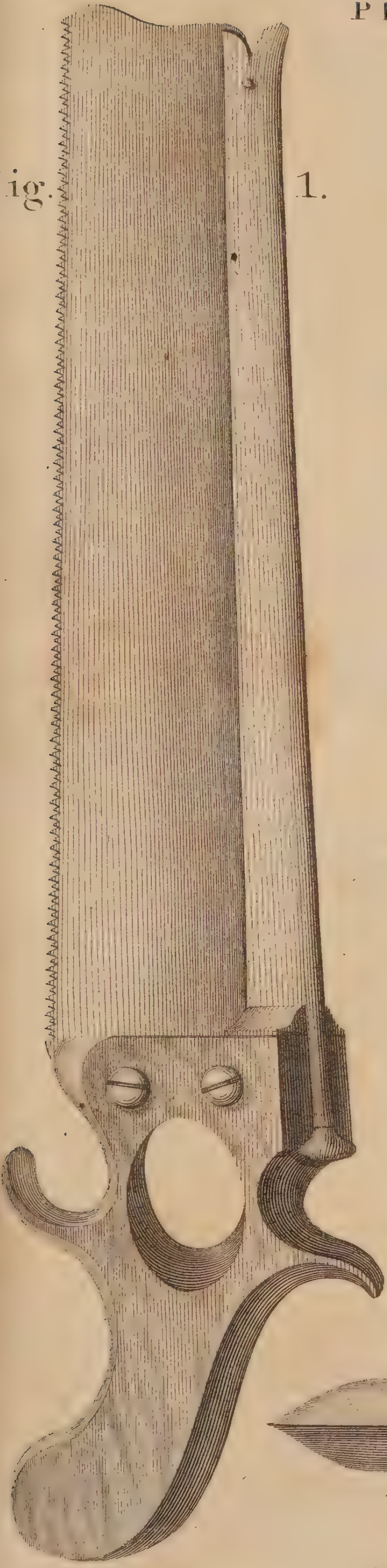


Fig. 2.

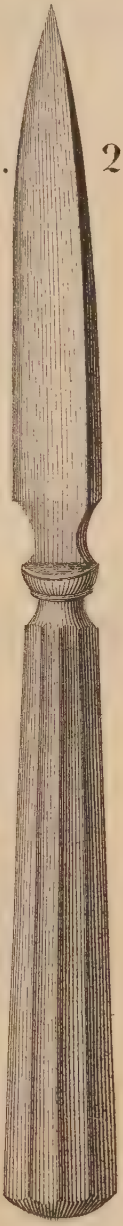


Fig. 3.

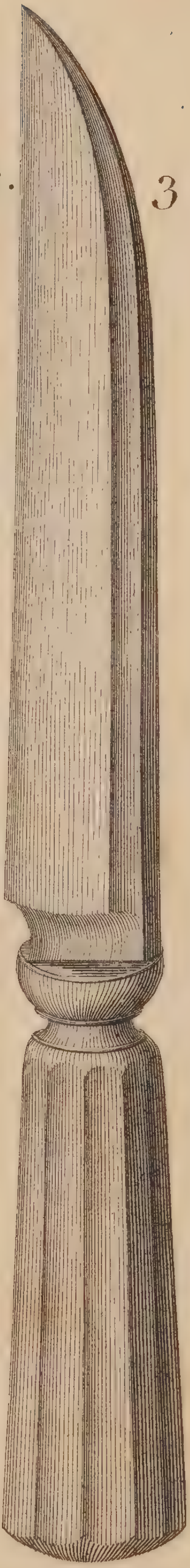
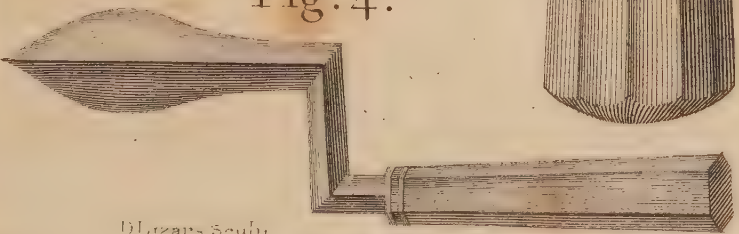


Fig. 4.



D.Lizars Sculp

PLATE XCVIII.

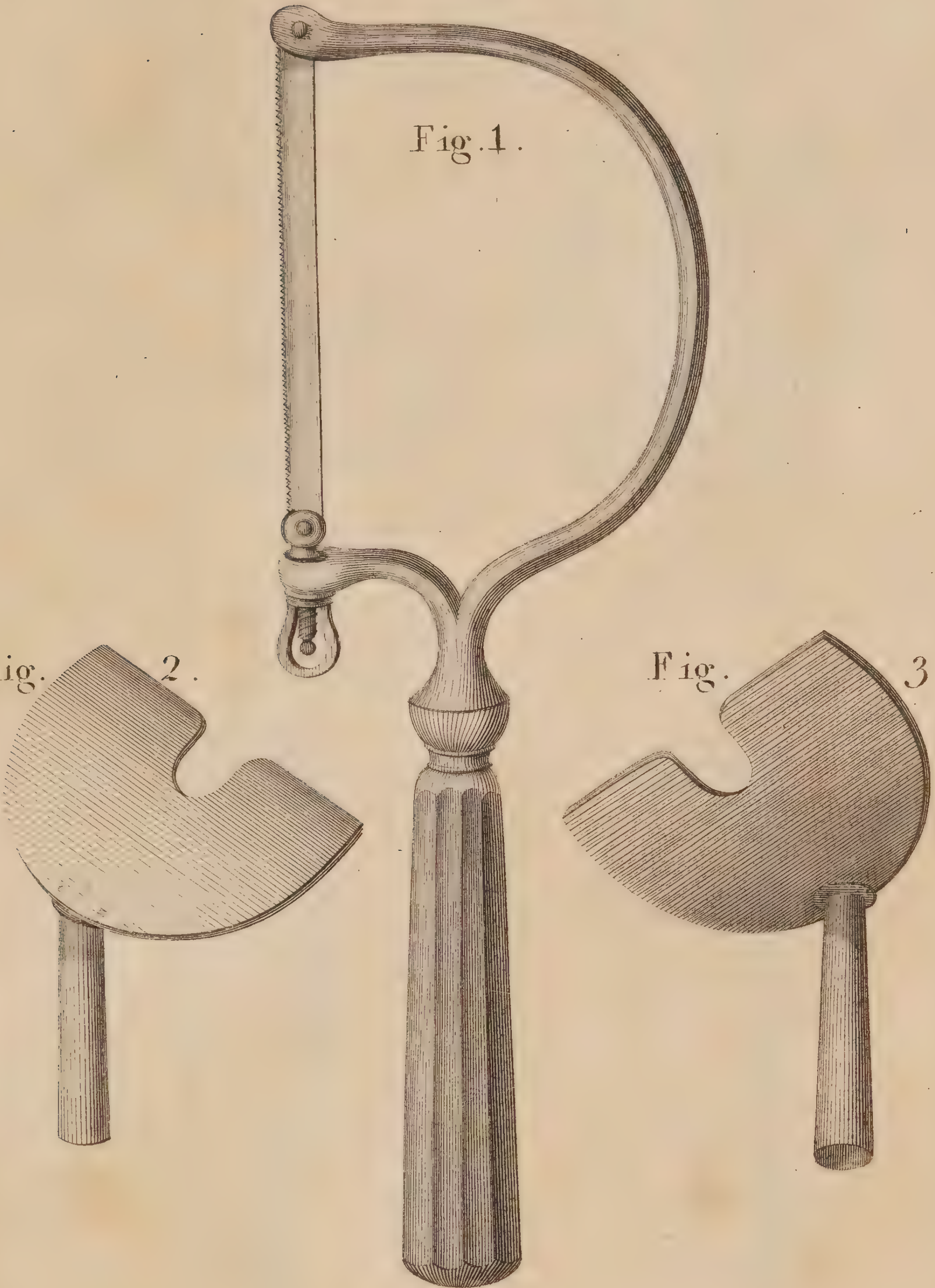
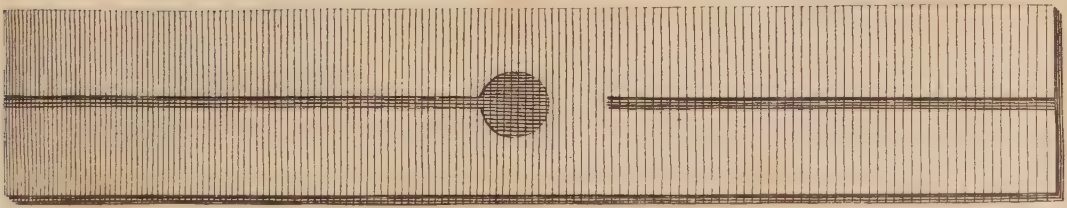


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.



D Lizars Sculp

PLATE XCIX.

Fig. 1.

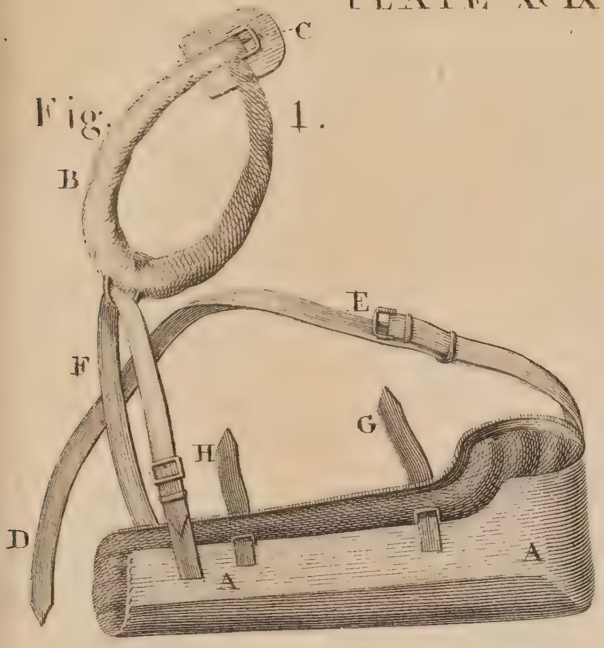


Fig. 2.

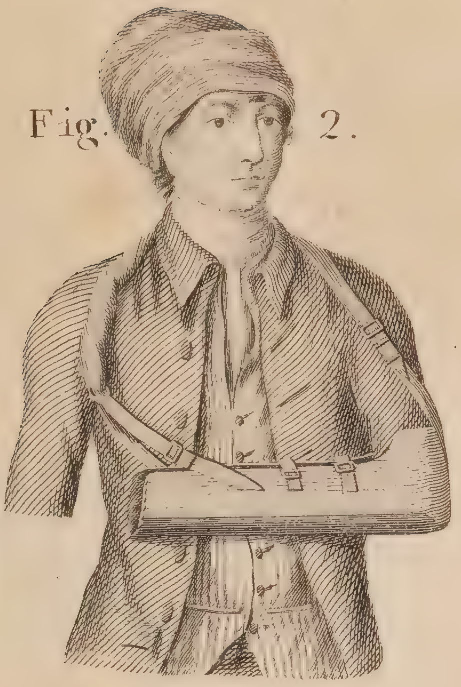
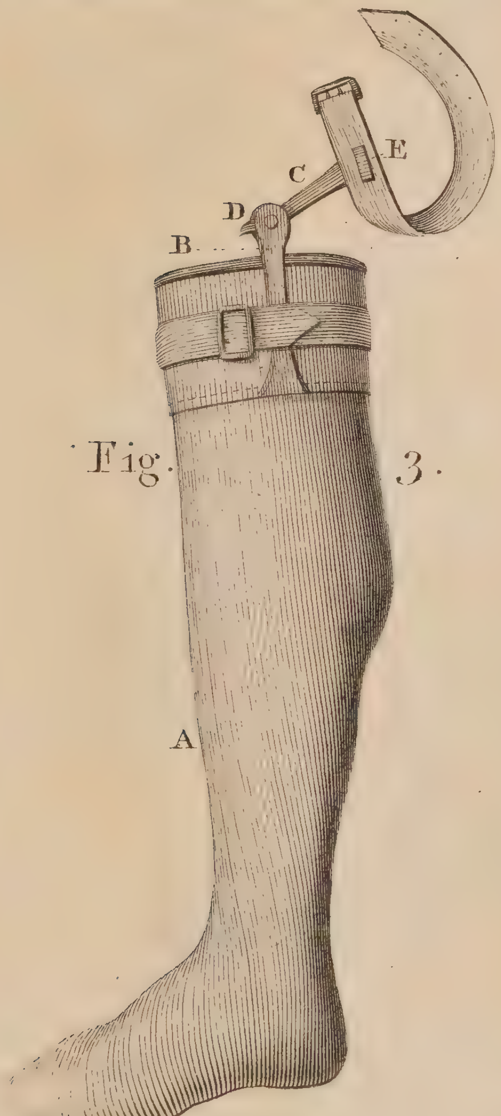


Fig. 3.



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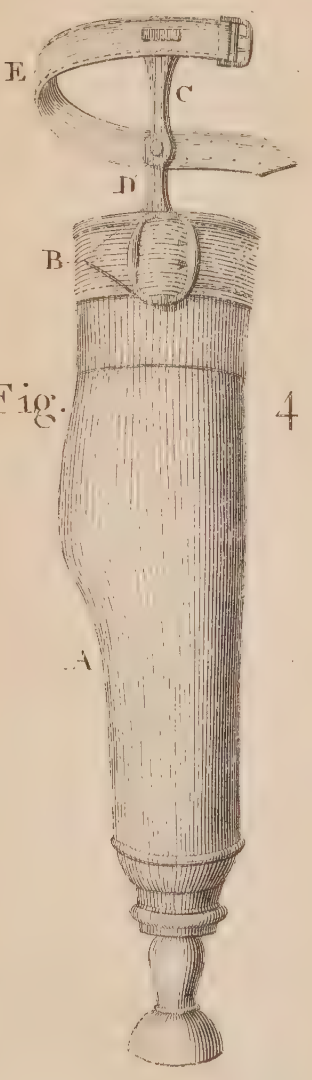
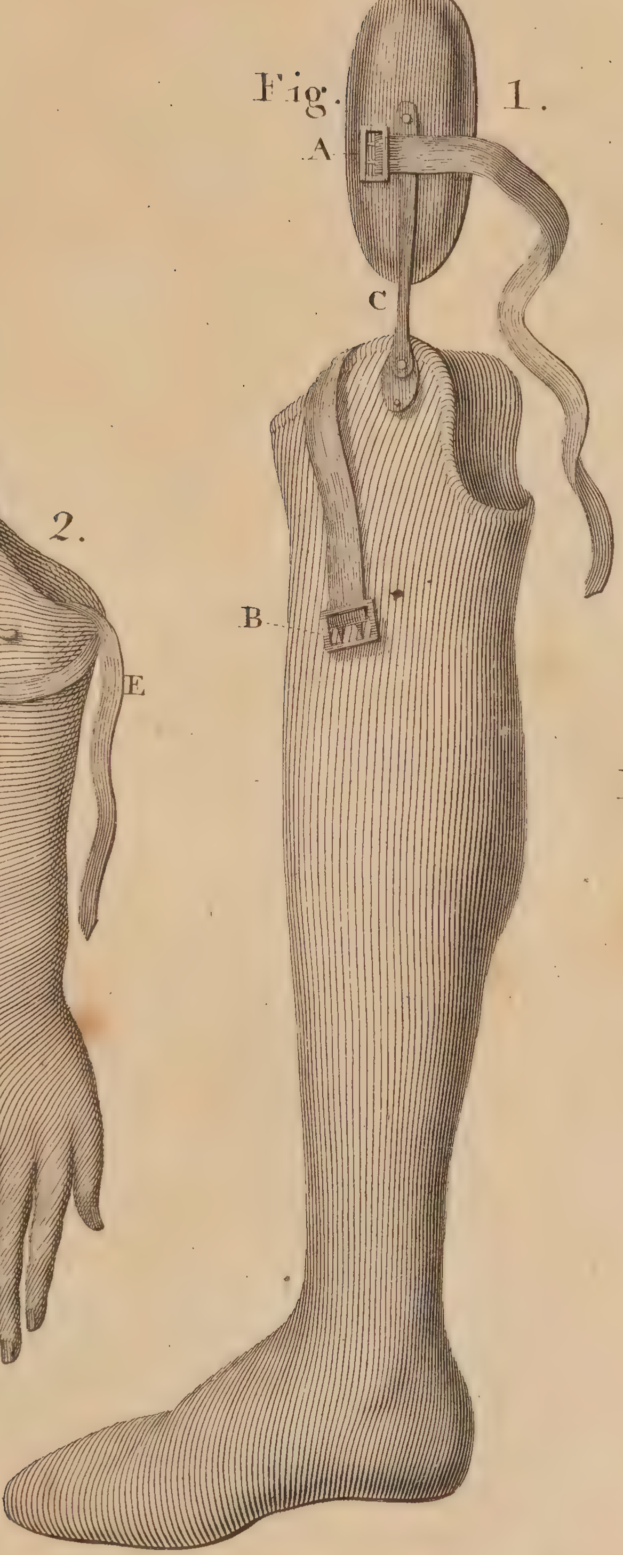


D.Lizars Sculp.

PLATE C.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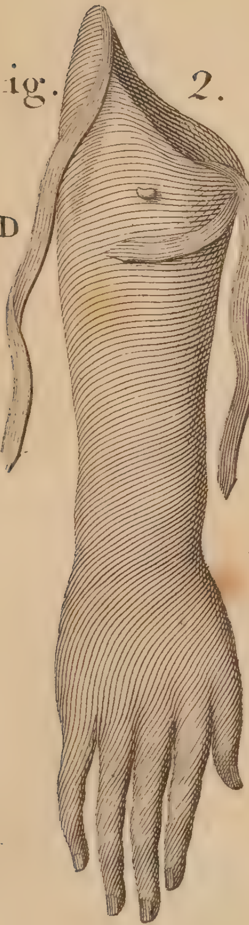
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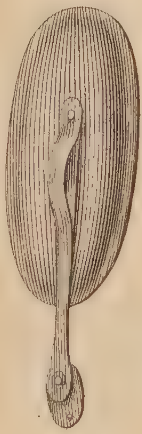
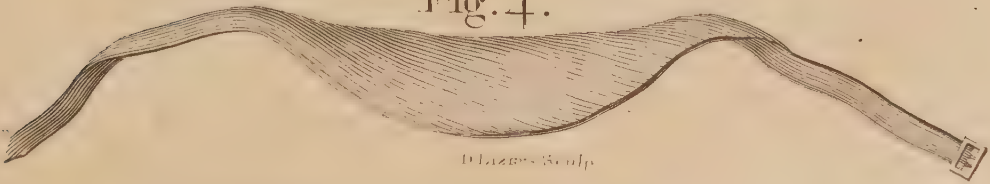


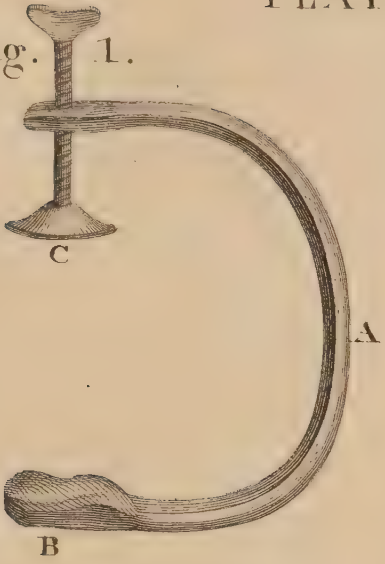
Fig 3.

Fig. 4.


D Lizars Sculp

PLATE CI.

Fig. 1.



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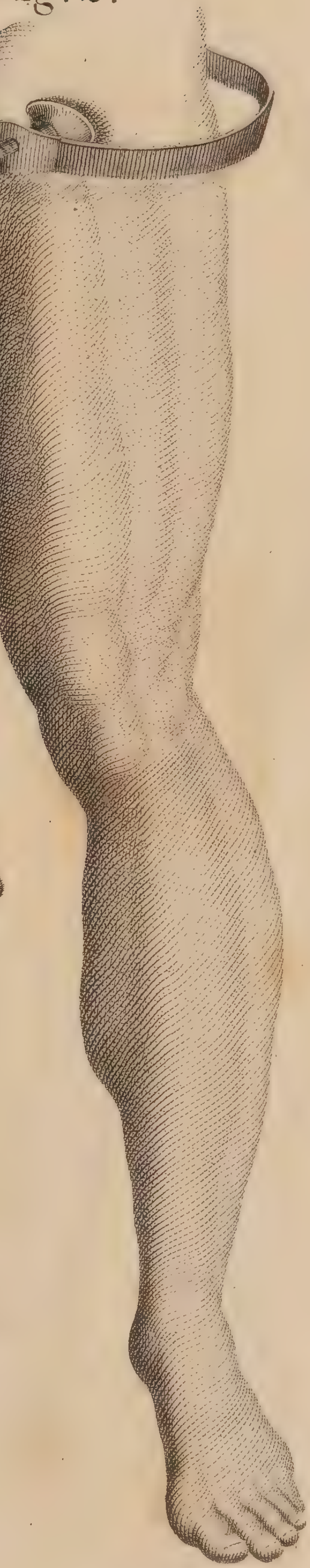

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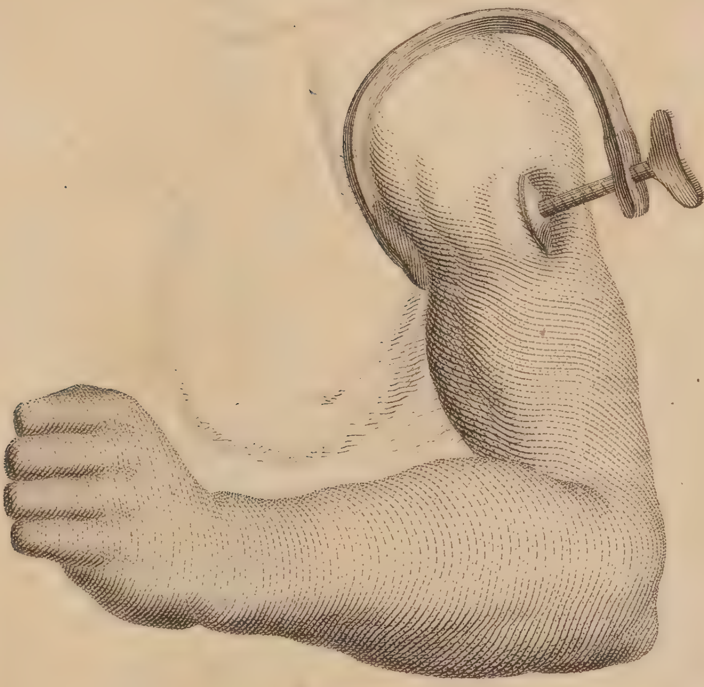
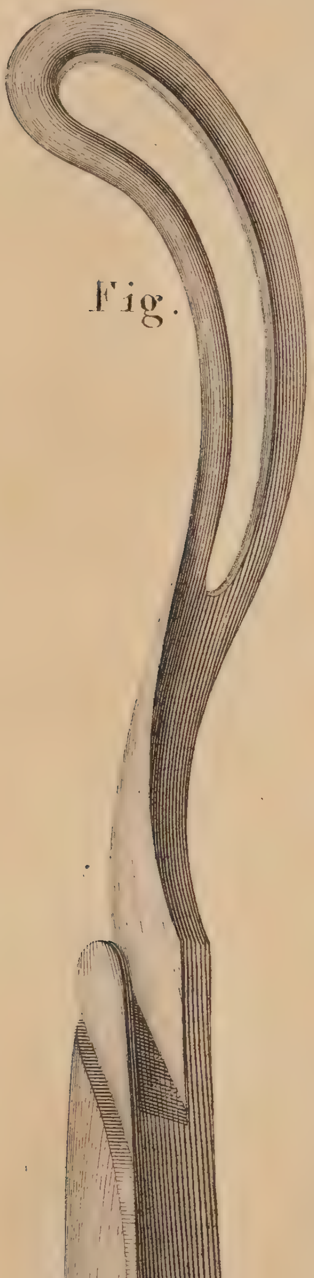


J. Lizars Sculp

PLATE CII.

Fig. 1.



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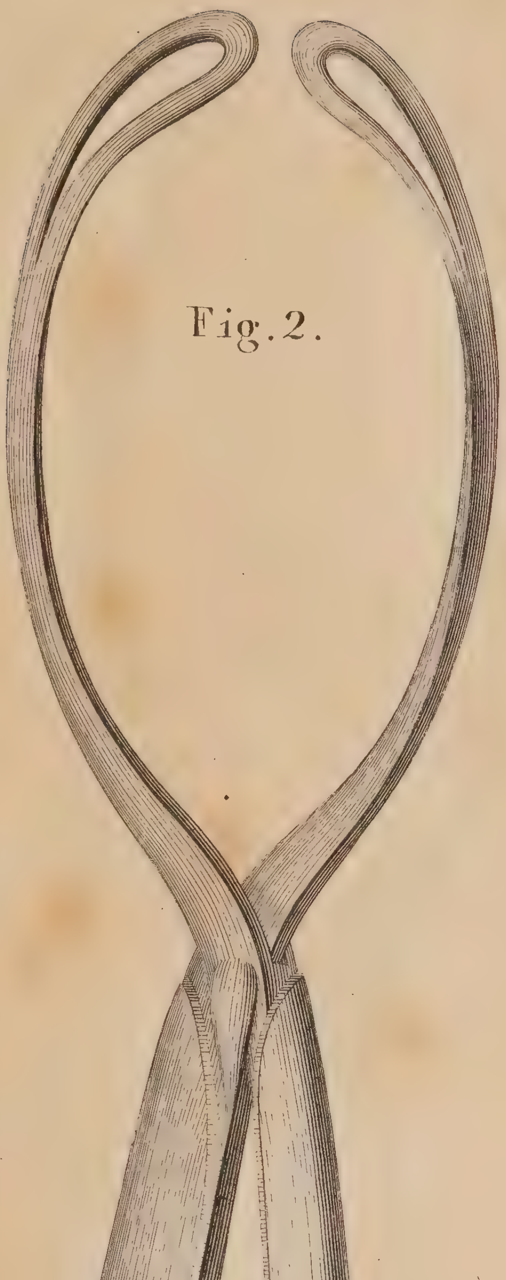


D.Lizars Sculp

PLATE CIII.

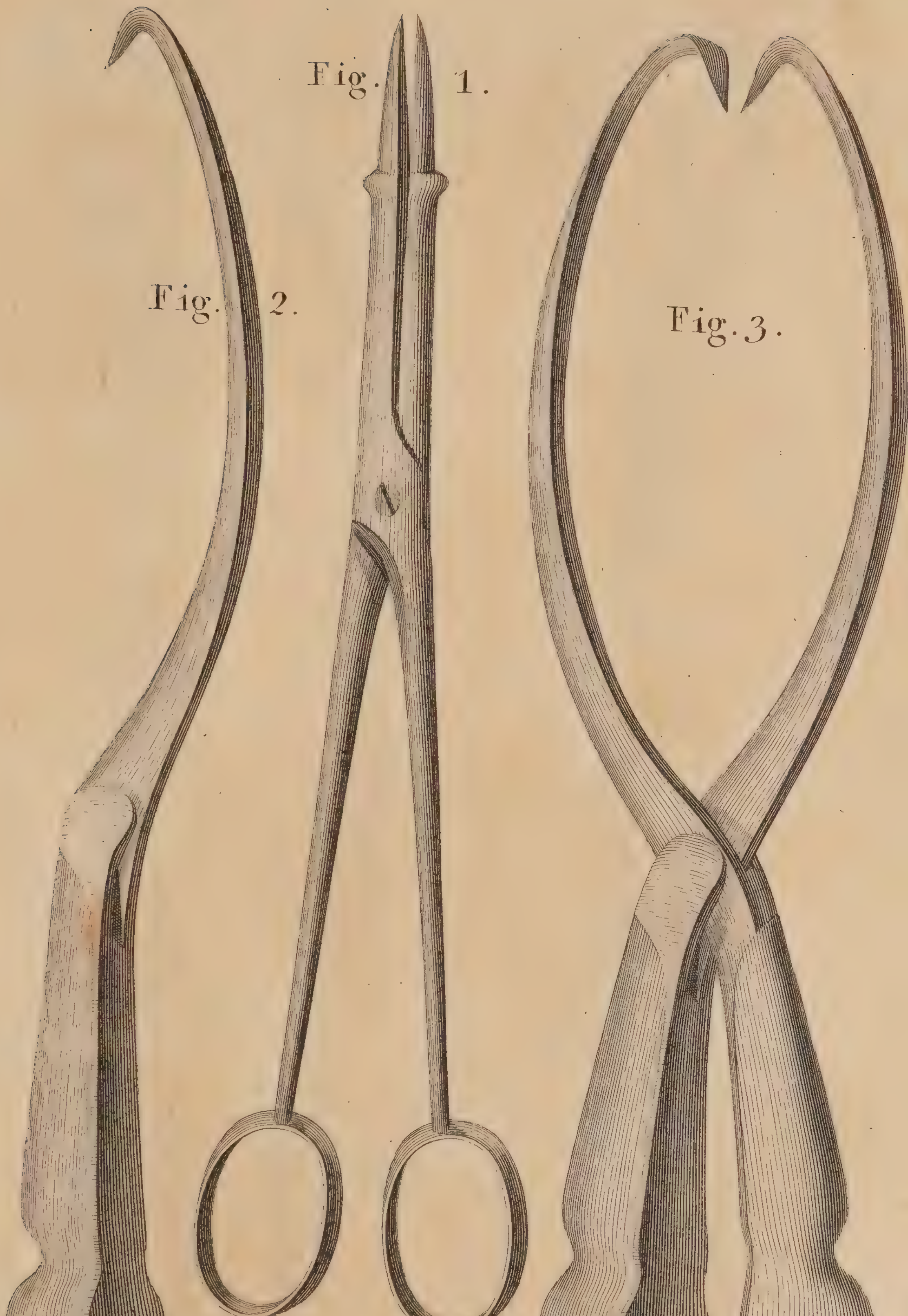


Fig. 1.

Fig. 2.

Fig. 3.

D.Lizars Sculp

PLATE CIV.

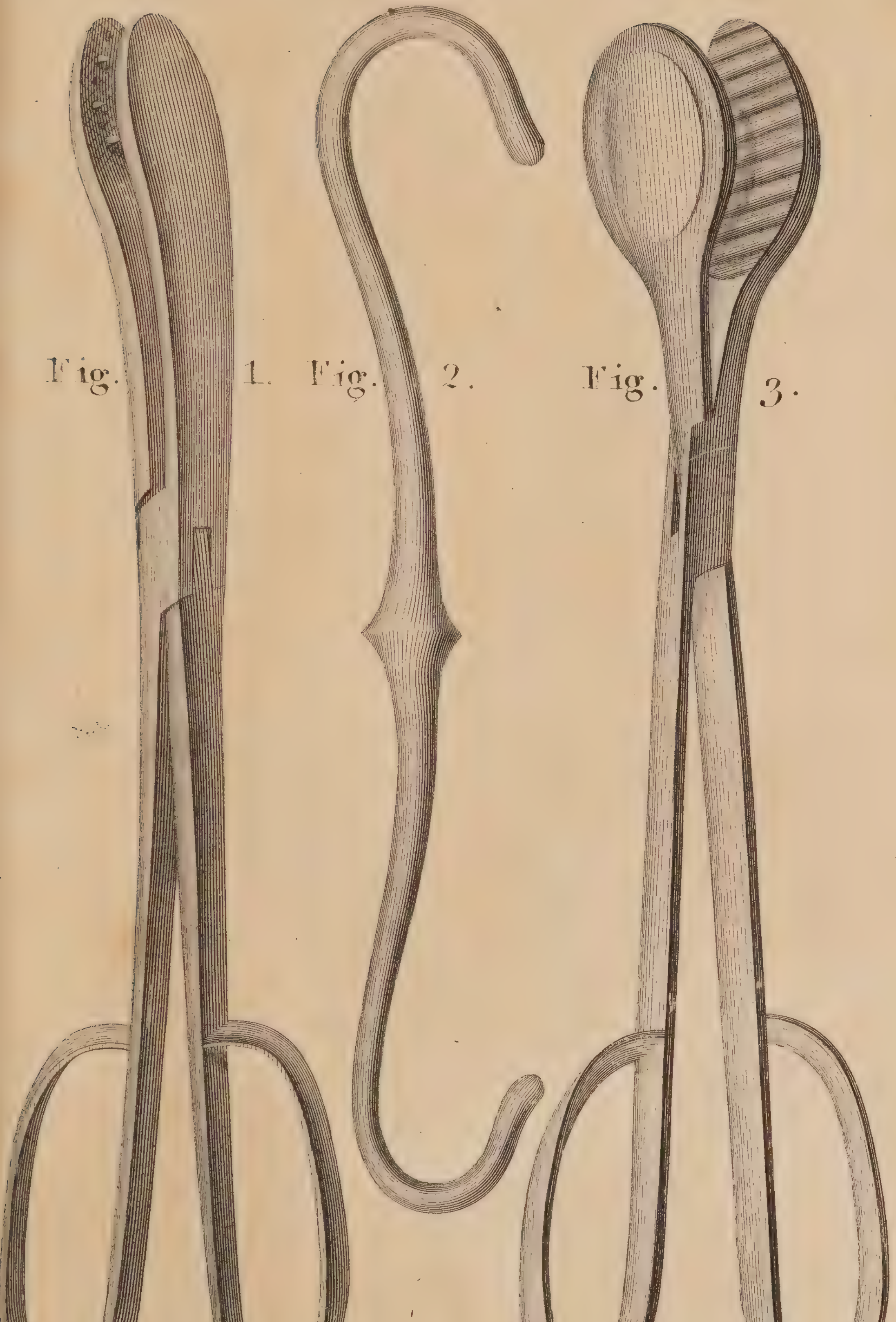


Fig. 1. Fig. 2. Fig. 3.

D Lizars Sculp.

PLATE CV.

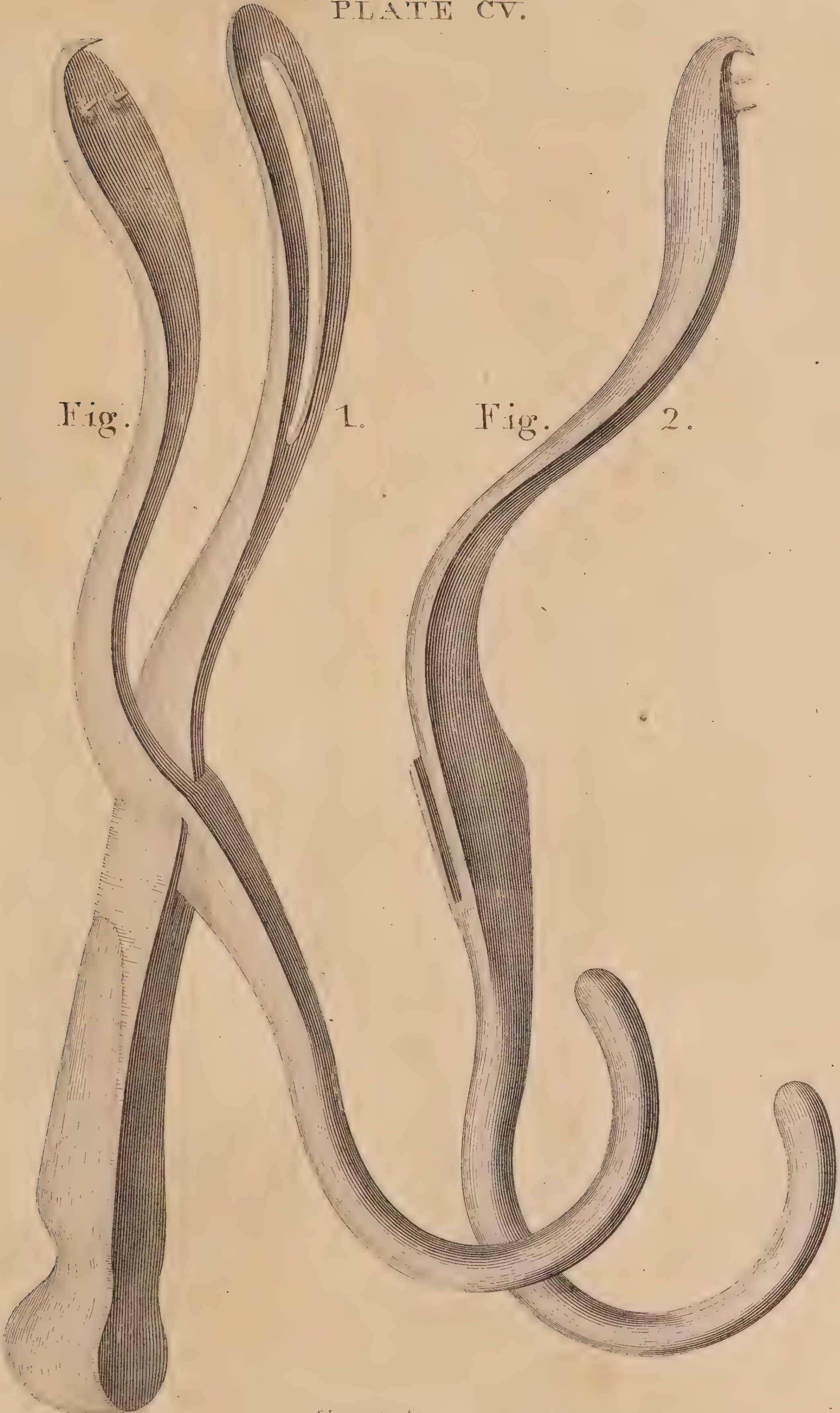


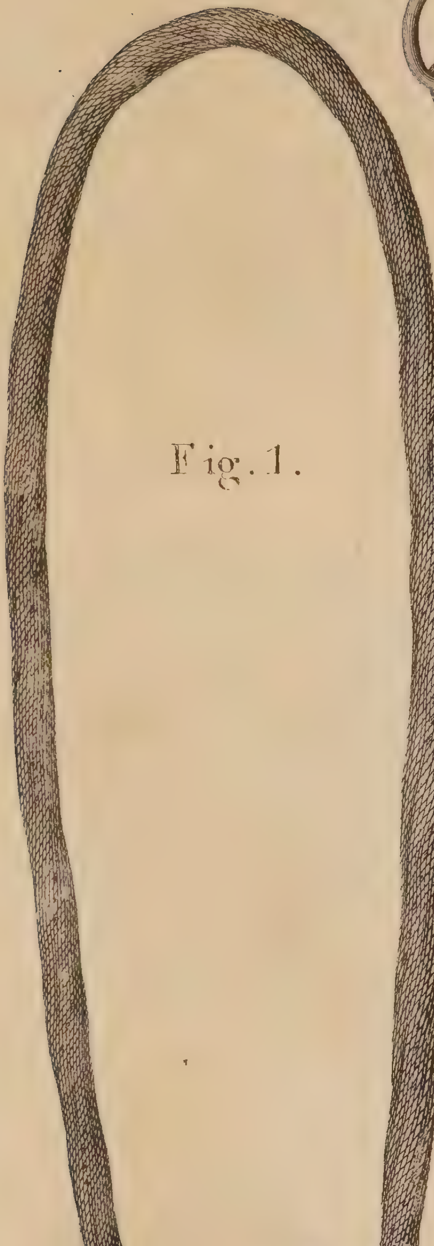
Fig. 1.

Fig. 2.

D. Lizars Sculp.

PLATE CVI.

Fig. 1.



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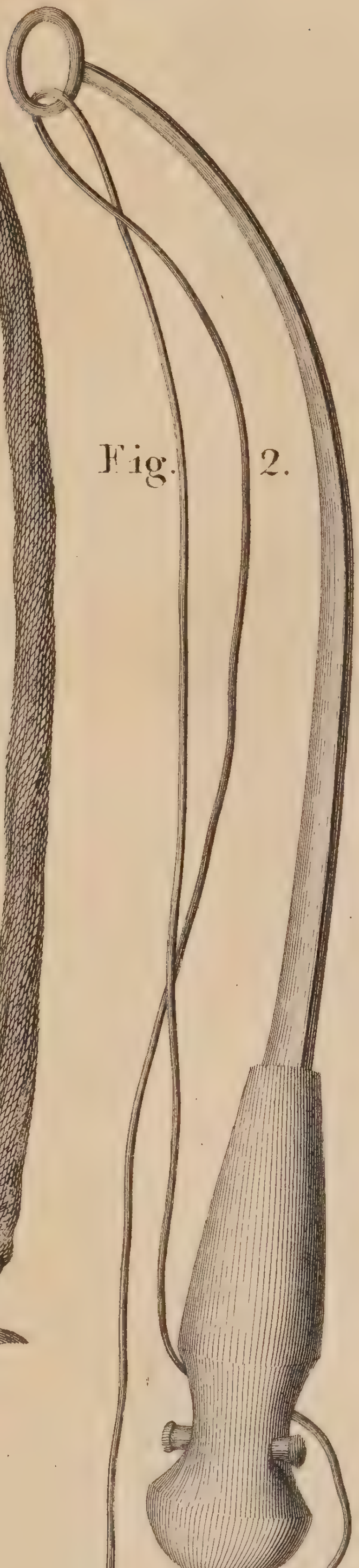

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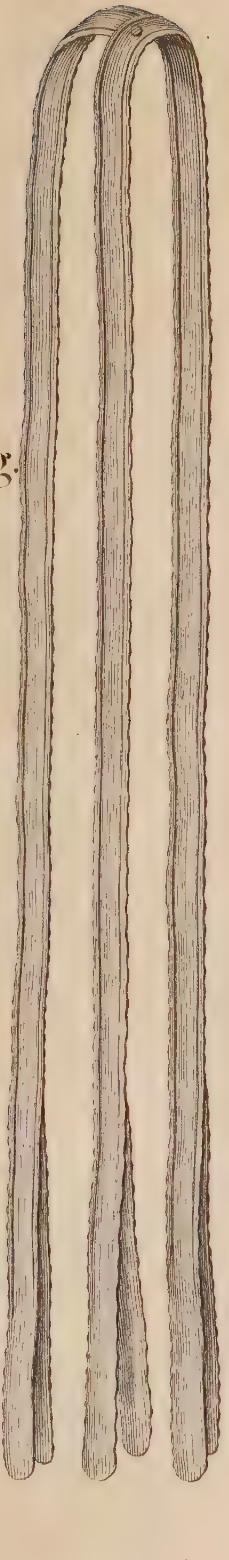
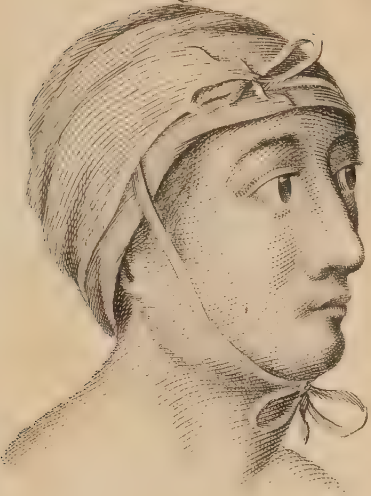


D.Lizars Sculp

PLATE CVII.

Fig. 1.



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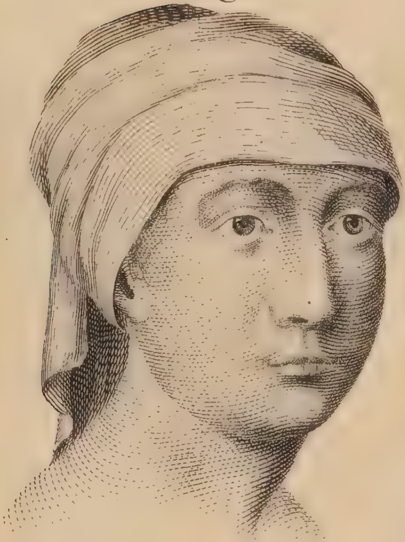

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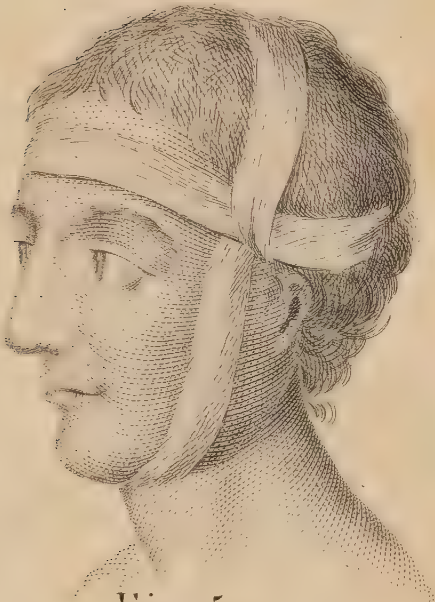

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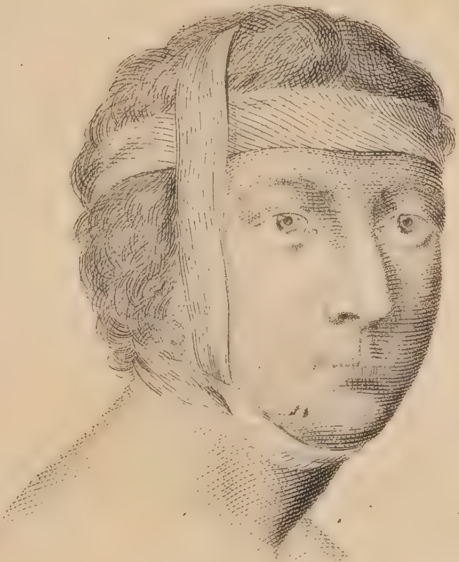

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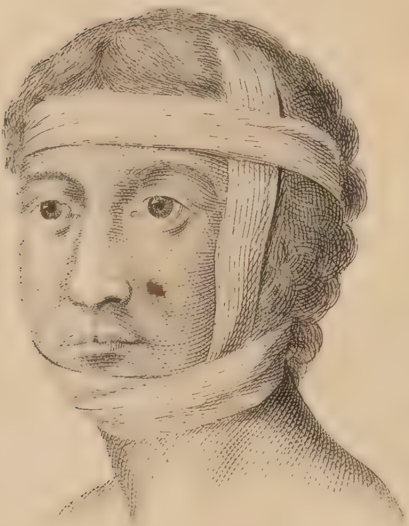

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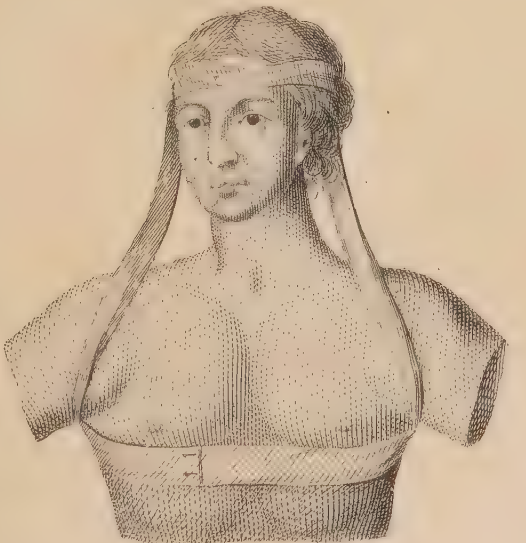
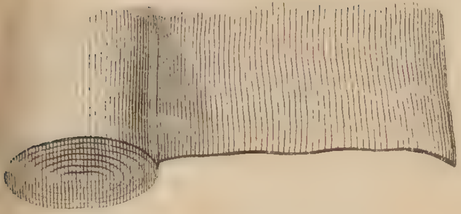


D.Lizars Sculp

PLATE CVIII.

Fig. 1.



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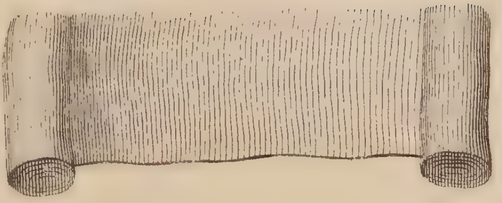

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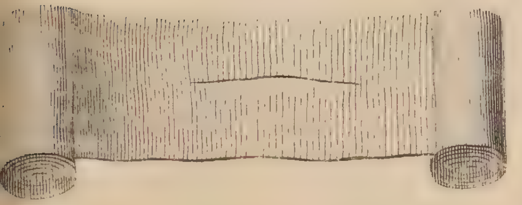

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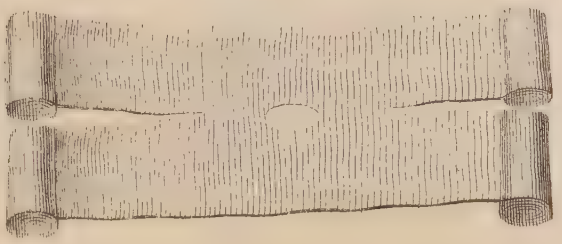

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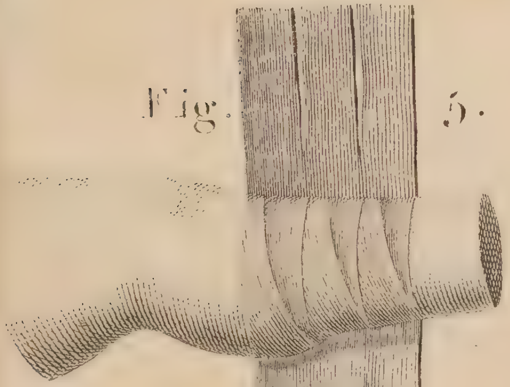

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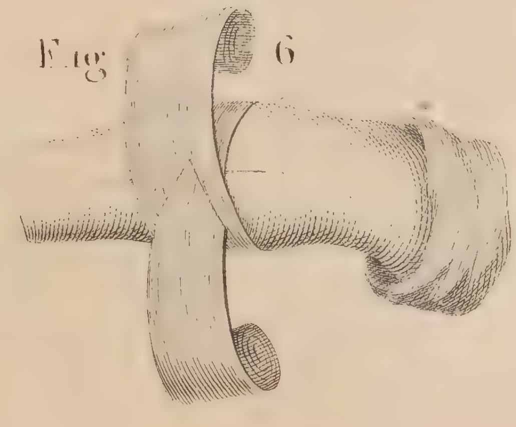

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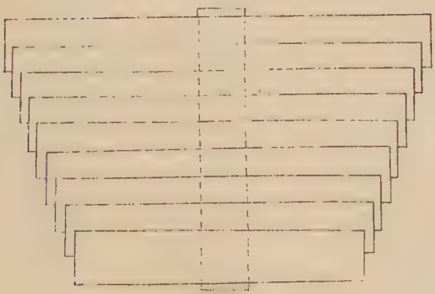

PLATE CIX.

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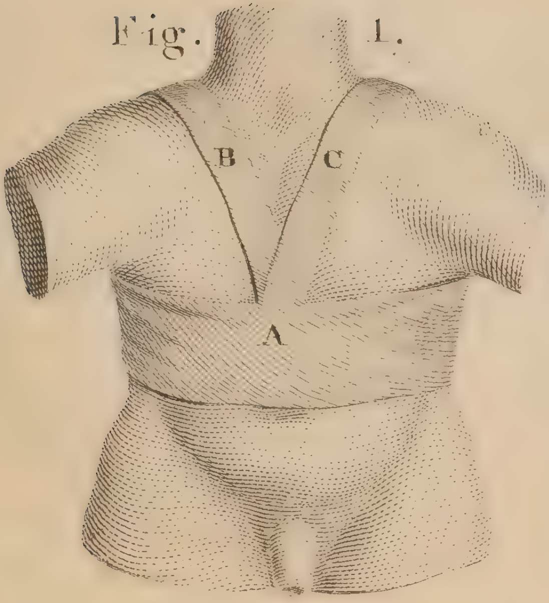

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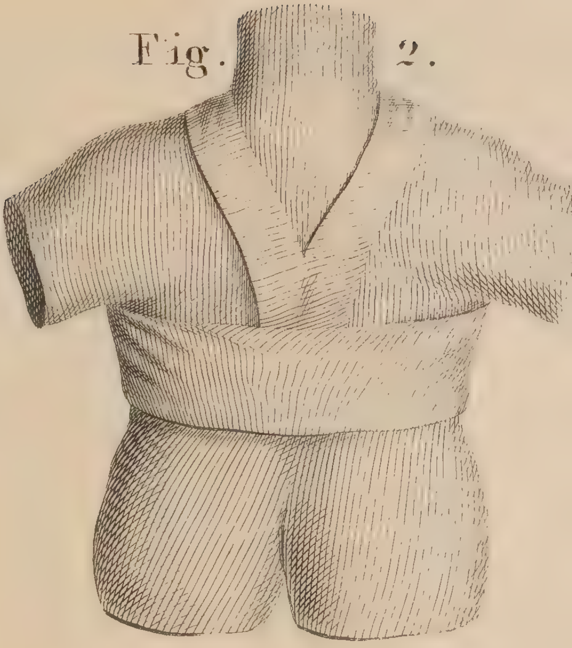

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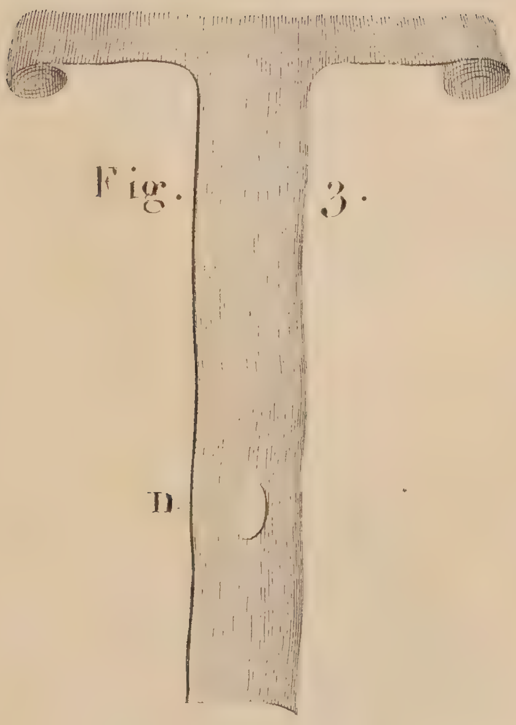

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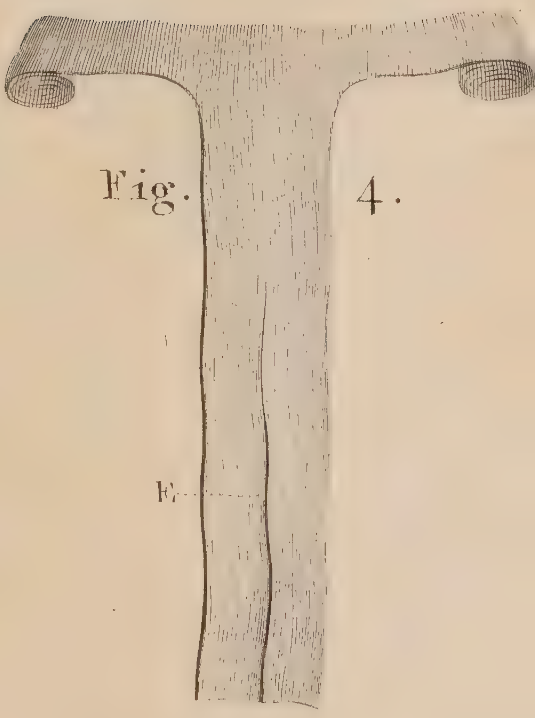

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PLATE CX.

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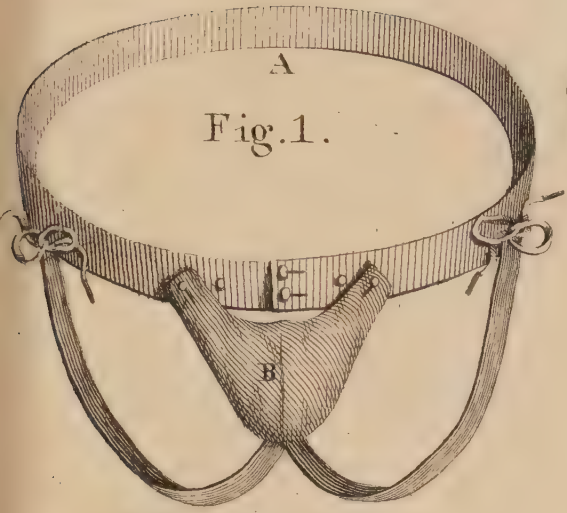

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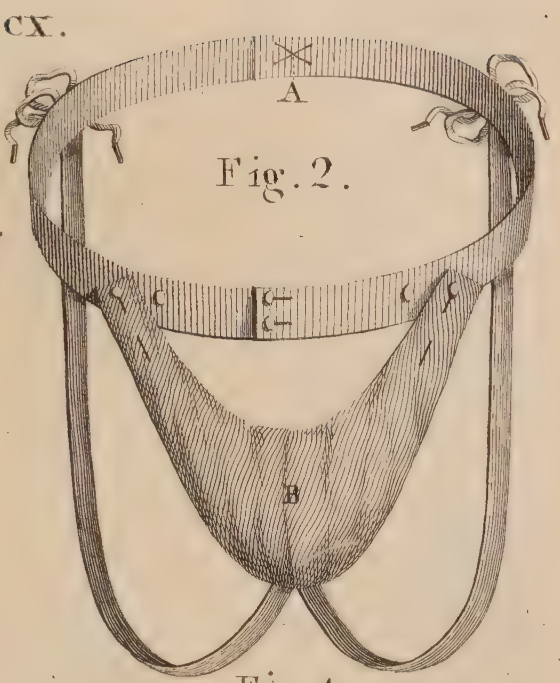

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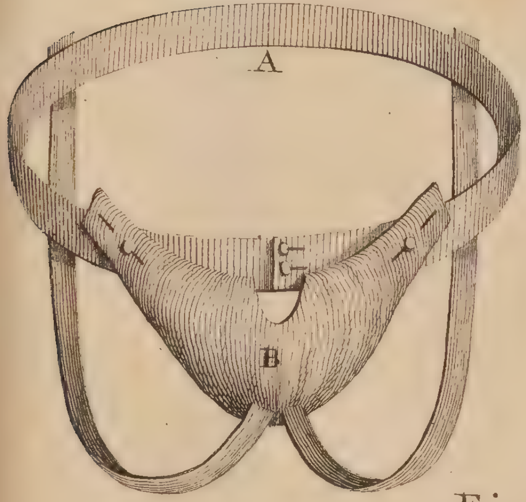

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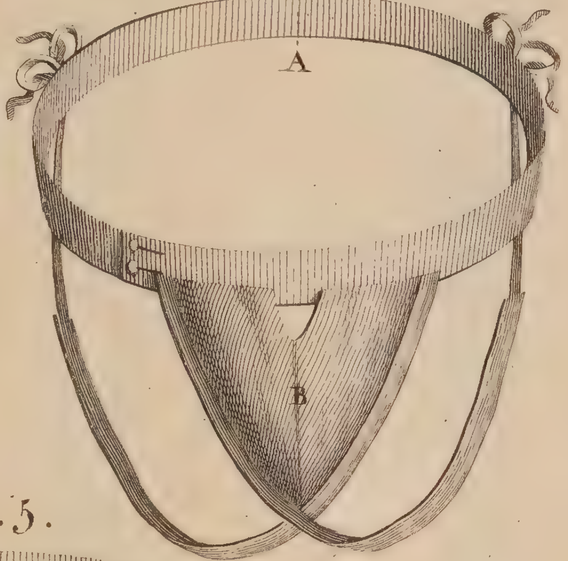

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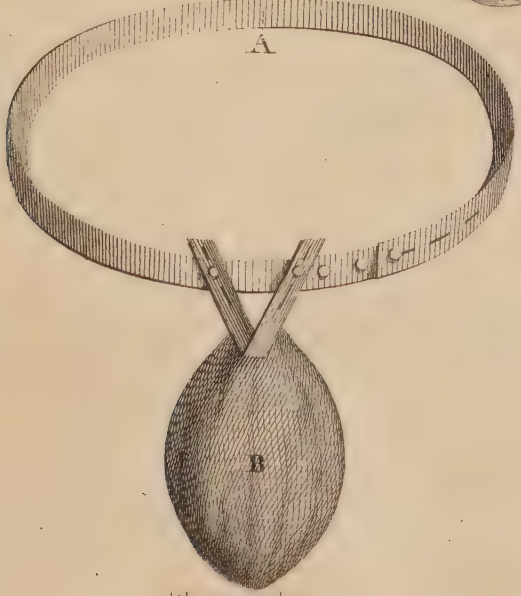


D. Lizars sculp

PLATE CXI.

Fig. 1.

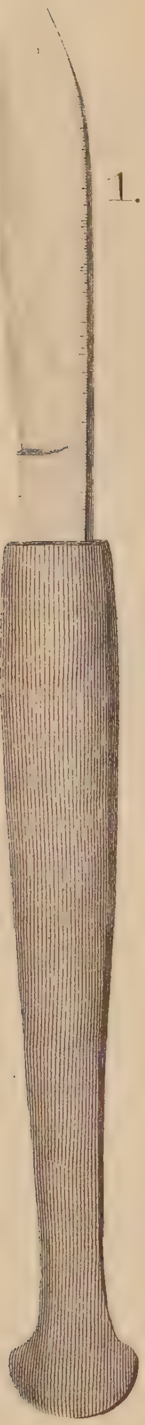
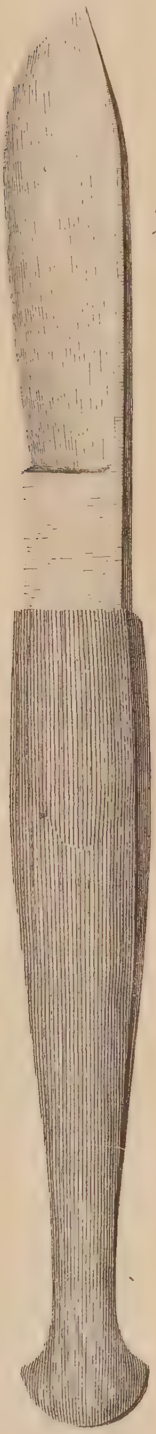


Fig. 2.



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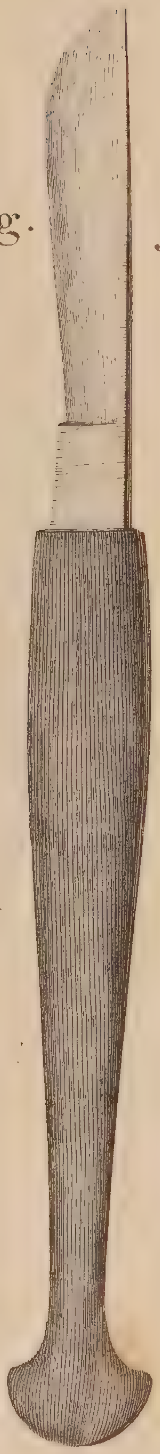

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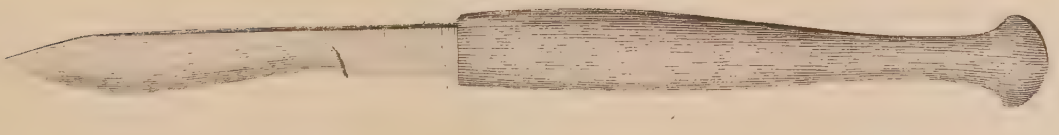
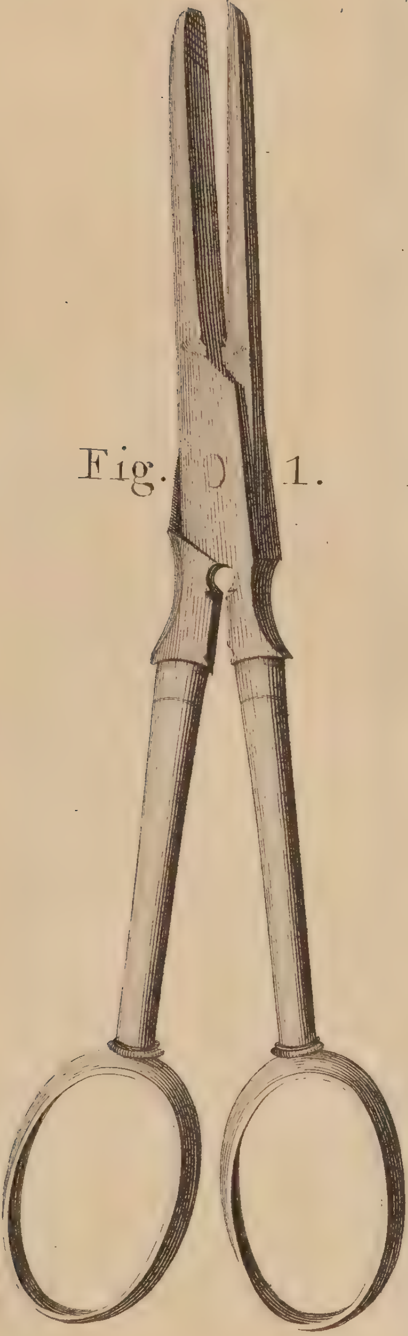


D.Lizars Sculp

PLATE CXII.



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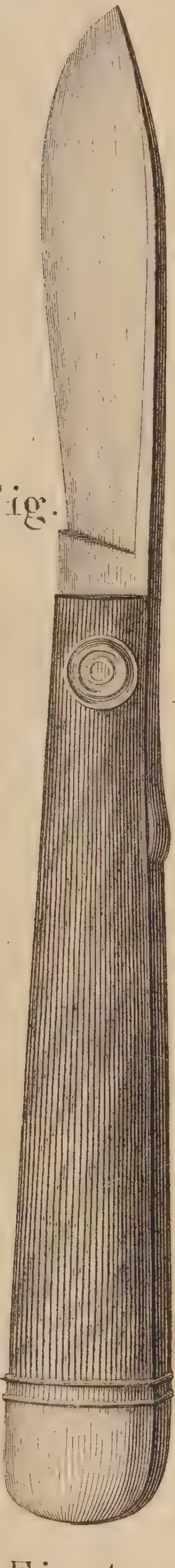

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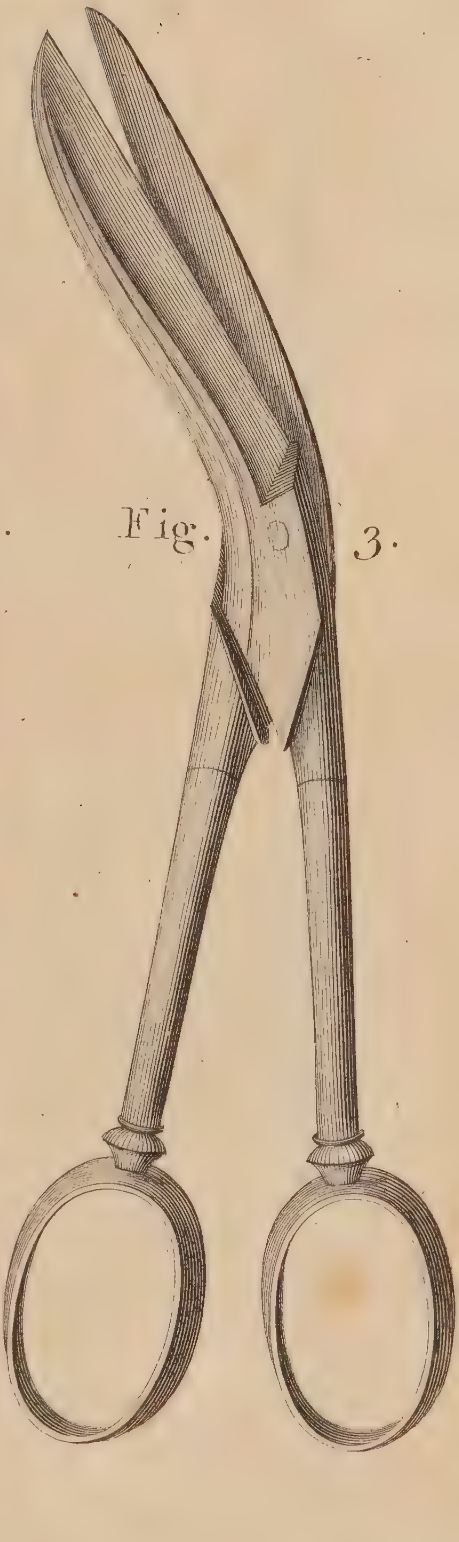

Fig. 3.

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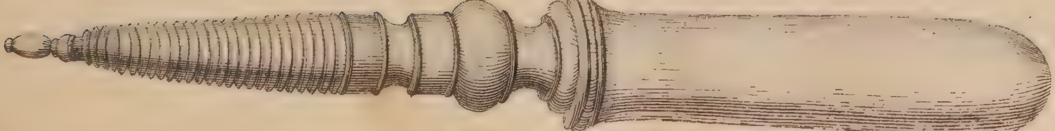


D. Lizars sculp.

PLATE CXIII.

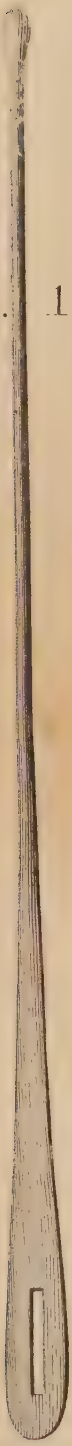
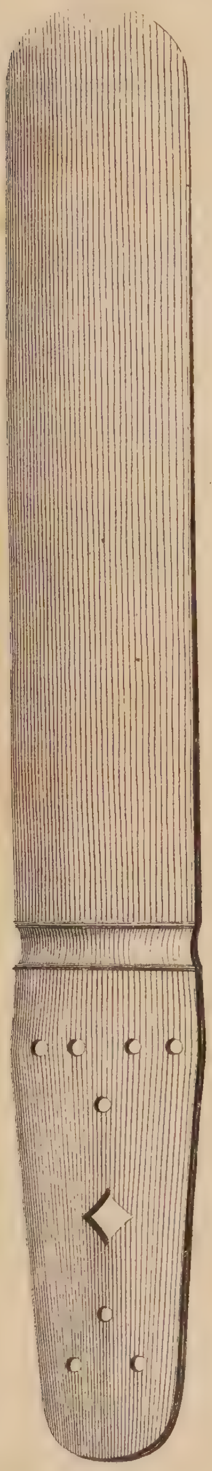


Fig. 1.



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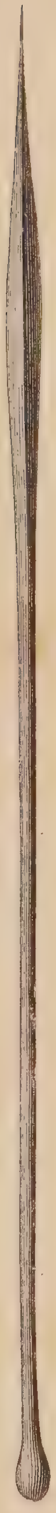

Fig. 3.

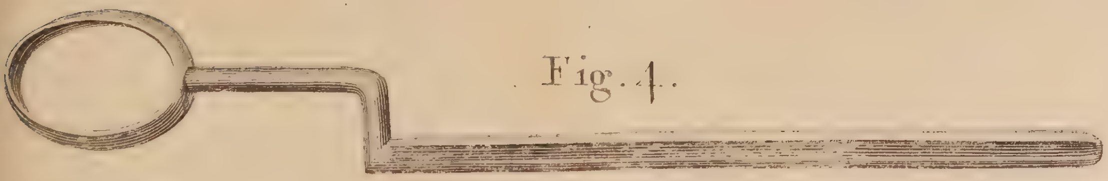

Fig. 4.

D. Lizars Sculp.

EXPLANATION

OF THE

PLATES.

PLATE LXXXVIII.

Fig. 1. THIS repreſents the Ambe of Hippocrates, for the reduction of luxations of the humerus: It conſiſts of a fulcrum and moveable lever. As it is ſtill uſed by ſome practitioners, I judged it proper to mention it; but I have elſewhere had occaſion to remark, that it is a dangerous inſtrument, and ought never to be employed. My reaſons for thinking ſo are enumerated in Chap. XL. Sect. IX.

Fig. 2. Mr Petit's inſtrument for reducing luxations of the humerus. *A A*, Two arms or horns, by which the ſcapula is kept firm during the extenſion. *B B*, The other end of the inſtrument reſting upon the ground; *C*, the pullies; *D*, ropes, by winding up which with the handle *E*, the limb may be ſlowly and gradually extended to any neceſſary degree.

Fig. 3. *G*, An opening through which the arm is paſſed; *F F*, two apertures for receiving the ends *A A* of the inſtrument, fig. 2. This being made of firm leather, the inſtrument is thereby prevented from fretting or galling the ſkin.

PLATE LXXXIX.

Fig. 1. The ambe of Hippocrates, repreſented by itſelf in the preceding Plate, is here applied, and ready to be uſed.

Fig. 2. Pullies for extending diſlocated bones.

Fig. 3. This is a very uſeful part of the apparatus for extending diſlocated limbs: It is formed of thick ſhamoy or buff leather. By tying it firmly round the limb with the broad ſtraps at each end, a very conſiderable force may be applied by aſſiſtants pulling the ropes or ſtraps paſſed over the hooks: It anſwers the purpoſe both more eaſily and more effectually than the common method of extending the limb with towels.

PLATE XC.

In this Plate I have delineated one of the beſt inſtruments hitherto known for diſlocations of the ſhoulders, when more than ordinary force is required. It is the invention of the late Mr Freke of London.

As inſtruments of this kind require to be very portable, Mr F eke has paid particular attention to this circumſtance. The box, fig. 5. contains the whole apparatus: When ſhut, it is only one foot eight inches long, nine inches broad, and three inches and a quarter deep. Fig. 4. repreſents the inſtrument open, the two ſides of the box being firmly fixed together by braſs hinges at *C*, and with two hooks and eyes on the other ſide of the box. When one end of it is fixed on the ground, the other ſtands high enough to become a fulcrum or ſupport for the lever *B B*, which is fixed on the roller *E* by a large ſcrew of wood, which turning ſideways, as well as with the roller, it obtains a circumrotatory motion, ſo that it may ſerve with proper attention to reduce a luxation either backward, forward, or downward.

The roller on which the lever is fixed is juſt the diameter of the depth of one of the boxes, into which are driven two iron pins, the ends of which are received by the two ſides of the box, which are an inch thick.

The lever is two feet four inches long, and is cut and joined again by two hinges at *C*, to fold up ſo as to be contained in the box: On the back-ſide of it is a hook to keep it ſtraight; the other end of it hangs over the roller an inch and a half, which is to be excavated and covered with buff-leather for the more eaſy reception of the head of the os humeri.

The iron roller *E*, has two holes through it for receiving two cords from a brace, fig. 3. fixed on the lower head of the os humeri, for on no other part of the arm above the cubit can a bandage for this purpoſe be uſeful; for, if the ſurgeon applies it on the muſcular part of the arm, it never fails to ſlip down to the joint before the limb can be extended.

The iron roller *E* has a ſquare end, on which is fixed a wheel *D*, notched round, which works as a ratchet on a ſpring ketch under the lever; by which it is ſtopped as it is wound up with a winch, ſo that at pleaſure it may be let looſe by diſcharging the ketch.

The brace, fig. 3. conſiſts of a large piece of buff-leather, large enough to embrace the arm, ſewed on two pieces of ſtrong iron curved plates rivetted together, one of them having an eye at each end to faſten two cords in: The other is bent at the ends into two hooks, which receive the cords after they have croſſed the arm above.

In order to keep the patient ſteady in his chair, and to prevent the ſcapula from raiſing or depreſſing the lever, after the limb is drawn forward by the winch, there muſt be fixed over the ſhoulder a girth with two hooks at the end of it, ſuch as is repreſented in fig. 2. The girth ſhould be long enough to reach the ground on the other ſide, where it muſt be hooked into the ring *B*, ſcrewed into the floor for that purpoſe, as in fig. 1.

PLATE XCI.

The figures in this plate repreſent an inſtrument mentioned in Chap. XLI. for the purpoſe of removing contractions of the ham-ſtrings or flexor tendons of the leg.

Fig. 1. A front view of the inſtrument: *A A*, two curved ſteel plates connected together by a firm ſteel ſplint *D*, in fig. 2. One of theſe is to be applied to the back part of the thigh, and the other to the upper and back part of the leg; while, by means of the leather ſtraps *E E*, ſuch a degree of preſſure is made as the patient is able to bear.

B B, fig. 1. Is a ſoft cuſhion of quilted cotton for ſurrounding the limb to prevent excoriation by the leather ſtraps. The curved plates *A A* ſhould for the ſame purpoſe be lined with ſhamoy.

Fig. 2. A back view of the ſame inſtrument.

Fig. 3. A limb with the inſtrument applied on it.

Plate XCII.

In this Plate I have delineated an apparatus mentioned in Chap. XLI. for diſtortions of the legs.

Fig. 1. *A B*, An iron ſplint properly covered with ſoft leather fixed in an iron frame *C*. The ſplint may be made to fix on either ſide of the frame according as the leg is curved to one ſide or another. In a diſtorted leg the foot is to be fixed down to the frame *C* by means of the ſhoe repreſented in fig. 3. This is eaſieſt done by paſſing a nail through the heel of the ſhoe into the frame, upon which the ſhoe may move. If the leg is bent outward, the ſplint *A B*, fig. 1. is placed on the inſide, and it ſhould be of ſuch a length that the pad *B* may reſt upon the internal condyle of the knee-joint, where it ſhould be fixed by the ſtrap E, fig. 3. When the

bones are bent inward, the ſplint muſt be placed on the outſide of the leg.

The ſtraps *F F* muſt be paſſed two or three times round the convex part of the leg, which it ought to compreſs with ſome degree of force toward the ſplint; and by increaſing the preſſure from time to time, the curvature or convexity will be gradually leſſened till at laſt it may in many inſtances be totally removed. By means of the ſtrap *G*, fig. 3. the toes are to be drawn from that ſide to which they incline, and fixed to the oppoſite ſide of the frame. The ſcrew-nail *D*, fig. 1. determines what is gained from time to time, by moving it from one hole in the frame to another.

Fig. 4. A machine invented by the late Mr Gooch, for giving ſupport to weak limbs as well as for removing diſtortions. *A A A*, three ſteel-bows made thin and very elaſtic: They muſt ſtand clear of the tibia; muſt paſs about half round the limb, and be fixed with ſtraps of leather upon round-headed pins.

B B B, a longitudinal plate, to be made of tough ſtuff, as the workmen term it, and as light as poſſible with ſufficient ſtrength.

C, the ſhank to paſs into the ſocket, in that part of the machine which is to be fixed into the heel of the ſhoe or laced boot, and confined there by a ſcrew at the bottom.

D, The ſcrew to keep the ſhank in the ſocket.

PLATE XCIII.

Fig. 1. A machine invented by an ingenious tradeſman of this place, the late Mr Gavin Wilſon, for diſtortions of the leg. This ſubject was treated of in Chap. XLI. *A*, a caſe of firm leather open before, for receiving the diſtorted leg and foot. *B*, a ſplint of iron for giving additional firmneſs to the caſe. The leg being placed in this caſe, the foot is fixed down to the bottom or ſole by the ſtrap *H* paſſed through the hole *I*; and the leg

itſelf is gradually drawn either to one ſide or another according to the nature of the diſtortion, and ſecured by a proper application of the ſtraps *D F*, fixed upon the braſs hooks *G E*. By a due perſeverance in the uſe of this machine, many bad caſes of diſtorted limbs have been completely cured.

Fig. 3. A pair of ſhoes which have proved uſeful in ſome caſes of diſtorted ankle-joints, where the toes have been turned too much inward. Being light, they may be uſed even in early infancy. After the feet are fixed in the ſhoes by the laces before, the toes may be ſeparated to a proper diſtance, and preſerved in this ſituation by the apparatus at *A*; which conſiſts of three ſmall iron plates, more particularly delineated in fig. 5. and at *B*, fig. 4. Fig. 5. conſiſts of two parallel thin plates, fixed with nails to the outſide of the ſole of one ſhoe; and they are ſo far ſeparate from each other, as to receive the round plate *B* between them, the end of which is fixed to the ſole of

the other ſhoe. The three plates are connected together by a nail paſſing through the hole in the centre of all of them. This admits of a conſiderable degree of motion, by which the toes may be moved either outward or inward; but they can be eaſily fixed at any particular point by a ſmall iron pin at *A* paſſed through one or other of the holes in the ſide of the plates *B*.

PLATE XCIV.

In this plate I have delineated two machines for ſupporting the head and ſhoulders, commonly employed in diſtortions of the ſpine.

Fig. 1. *A*, An iron collar properly covered for paſſing round the neck. By means of the long iron plate connected with it, it may be raiſed or depreſſed at pleaſure. *B B B*, a broad iron plate fitted to the back and ſhoulders. *C C*, two ſtraps to be carried over the ſhoulders; and being brought through beneath the armpits,

pits, to be fixed, of a ſufficient tightneſs, on two knobs on the ſhoulder-plates, as may be ſeen in fig. 2. *D,* a ſtrap for fixing the plate going down the back, by tying it round the body.

Fig. 3. An iron or ſteel inſtrument, delineated by Heiſter for the ſame purpoſe with the preceding. *A A,* its tranſverſe part, to which are faſtened iron rings *C C* for retaining and keeping back the ſhoulders. *B,* the perpendicular part going down the back. *D,* a band or ligature paſſing through an aperture in the lower end of the plate *B* for tying it firmly to the body.

PLATES XCV. and XCVI.

In theſe plates are repreſented an apparatus for removing curvatures of the ſpine. The invention is very ingenious, and we owe it to Mr Le Vacher, who made it public in the year 1768, in the 4th Volume of Mémoires de L'Académie Royale de Chirurgie de Paris. It has ſince that period been improved by Mr Philip Jones of London.

The chief intention of this inſtrument is to ſupport the head, and gently to ſtretch the ſpine: The ſtays *D D*, Plate XCVI., to which the inſtrument is attached, muſt be exactly fitted to the patient: *E E E*, are three loops of iron fixed to the ſtays, through which a firm ſteel-rod *A B C* is paſſed to ſuch a height, that the point of the curve at *A* may nearly touch the fore-head: *G*, is another curve of poliſhed ſteel, neatly adapted to the upper part of the head, over which it paſſes from ear to ear; and it is attached in a pendulous ſtate by the ſcrew *K* to the rod *A B C*, upon which it moves backward from *A* at pleaſure. *H H H*, is a ſtrap of firm leather, covered with ſilk, paſſing round the occiput, and fixed ſufficiently tight on two hooks or knobs to the two ends of the curve *G*. *I I* is another ſtrap of the ſame kind that paſſes beneath the chin, and is alſo attached by knobs or hooks to the curved plate *G*. On a proper application of theſe ſtraps, the utility of the inſtrument in a great meaſure depends. The one ſhould cover the chin, and the other be entirely below the occiput, and both of a degree of tightneſs adapted to the feelings of the patient.

The inſtrument being fitted to the patient in the manner repreſented in Plate XCV. the head is thereby completely ſupported, at the ſame time that the body is kept erect by the ſteel-rod *A B C.* This rod ſhould at firſt be placed as high as the patient can eaſily bear it, and every three or four days it ſhould be raiſed, which is eaſily done by touching the ſpring *F*; and after drawing the rod upwards, it is again firmly fixed by letting the ſpring fall into the correſponding notch.

In all curvatures of the ſpine, this machine proves uſeful, particularly where the diſeaſe is recent; but it requires to be worn for a great length of time: It ſoon tends to leſſen the deformity, but the parts quickly return to the ſame degree of curvature if it be not continued for two or three years.

Plate XCVII.

Fig. 1. The ſaw that I always uſe in amputating legs and arms: It ſhould be ſeventeen inches in length, including the handle, and two inches and a quarter in breadth at its broadeſt part.

Fig. 2. A ſmall double-edged knife, commonly termed a Catline, for dividing the interoſſeous ligaments and other ſoft parts in amputating the leg and fore-arm: It ſhould be nine inches long.

Fig. 3. An amputating knife, which anſwers either for the thigh, leg, or arm: It ſhould be thirteen inches in length.

Fig. 4. A ſmall crooked knife for ſeparating the muſcles from the bone in the manner I have adviſed in Chap. XLIV. Sect. IV.

PLATE XCVIII.

Fig. 1. A ſmall ſpring-ſaw uſed in amputating fingers and toes.

Figs. 2. and 3. Retractors made of thin iron plates for drawing up and ſupporting the muſcles and other ſoft parts in amputating limbs while the ſaw is applied to the bones. They ſhould be kept with openings of different ſizes, ſo that they may anſwer whether the bone is large or ſmall. Theſe retractors were firſt propoſed by Dr Monro, and they anſwer the purpoſe with much eaſe to the operator, and perfect ſafety to the patient.

Fig. 4. A piece of firm ſlit leather, which alſo anſwers the purpoſe of a retractor. Leather is better ſuited for this than linen, which is generally uſed, but neither the one nor the other anſwer ſo well as plates of iron.

PLATE XCIX.

In Chapter XCIX. Section V. as well as in other parts of this work, I had occaſion to recommend a caſe for ſupporting the fore-arm as preferable to any bandage. A repreſentation is given of it in fig. 1.

A A, a caſe or frame of firm leather, properly lined with flannel or wool, of a ſufficient length for covering the arm from the elbow to the point of the fingers. This is intended for the left arm. *B*, a collar of ſoft buff-leather for paſſing over the right arm, in order to ſupport the fore-part of the caſe by the ſtrap *F* paſſing over the left ſhoulder, to be fixed to a buckle at *C*, to prevent the collar *B* from ſlipping down. *G H*, Two ſtraps and buckles for fixing the arm down to the inſtrument.

The application of this inſtrument will be better underſtood by the view of it in fig. 2.

I was favoured with this inſtrument by Dr Monro, to whom, I believe, it was ſent by Mr Park of Liverpool.

Figs. 3. and 4. Two artificial legs, delineated by Mr White of Mancheſter in his Caſes in Surgery. Fig. 4. *A*, a hollow leg made of tin, and covered with thin leather. *B*, a leather ſtrap with a buckle on the outſide, for fixing it below the knee. *C D*, longitudinal ſteel bars, to be made as tough and light as poſſible, with ſufficient ſtrength. Theſe bars are joined by a moveable joint, to be placed exactly oppoſite to the knee-joint. *E*, a ſteel bow made thin and elaſtic, to paſs about two-thirds round the lower part of the thigh, and fixed with ſtraps of leather to buckle on the fore-part.

Fig. 3. Another artificial leg made in the ſame manner with fig. 4. with the addition of a foot made of light wood and moveable joints, ſo as to imitate pretty nearly the natural motions of the joints of the ankle and toes.

PLATE C.

In this plate I have given a repreſentation of an artificial leg and arm made by an ingenious artiſt of this place, who

I have in different parts of this Work had occaſion to mention, the late Mr Gavin Wilſon.

Fig. 1. An artificial leg made of firm hardened leather.

A, An oval piece of the ſame kind of leather, lined with ſhamoy, fixed upon a plate of iron *C*, and moving upon an axis at the knee. The ſtrap, with the buckle connected with it, ſerves to fix it to the thigh. There muſt alſo be an oval piece connected with a ſimilar iron plate on the oppoſite ſide of the thigh: Theſe iron plates and oval pads ſhould together go about nine inches up the thigh.

B, a ſtrap that comes from the ſole of the foot, and goes up the inſide of the leg to the middle of the thigh, where it is fixed by a buckle to a ſtrap coming from the oppoſite ſhoulder: This ſerves to ſupport the leg, and to take the weight of it more effectually from the weak ſide than any invention I have met with.

Fig. 3. The oval piece of leather and iron ſplint to which it is fixed.

Fig. 4. A piece of ſoft ſhamoy leather, which fixes by a buckle and ſtrap round the condyles at the knee. In this kind of leg, the perſon's weight reſts upon the condyles and patella, the ſtump itſelf hanging quite free within the leg. The band or ſtrap ſerves in the moſt effectual manner to prevent pain and excoriation, which otherwiſe would probably enſue from the friction of the leg againſt the knee.

Fig. 2. A fore-arm and hand made of the ſame kind of leather, and made to fix to the arm and ſhoulder by the ſtraps *D E.*

Theſe artificial legs and arms are preferable to any I have ever ſeen. The leg, when properly fitted, proves equally uſeful with the common timber leg, and it is preferable by being neater; at the ſame time that it is not apt to break, an accident to which the others are liable: And it anſwers better than a leg made of copper, from being conſiderably light-

er,

er, and not apt to be hurt in its ſhape by bruiſes.

Mr Wilſon makes three different kinds of legs correſponding to the part at which the limb is amputated. In amputating the leg lower than the uſual part, that is, in ſuch a manner that the motion of the knee is to be retained, it anſwers better at the diſtance of nine or ten inches from the condyles of the knee than either higher or lower. When higher, the remaining part of the leg does not ſupport the artificial leg in walking; and when much lower, the machine muſt be thicker about the ankle than would otherwiſe be required, by which it is rendered clumſy and heavy. Fig. 1. in this plate repreſents a leg for this part.

The ſecond kind of artificial leg which Mr Wilſon makes is intended for thoſe who have loſt the leg at the uſual place below the knee, where the weight of the body reſts on the knee-joint and upper part of the leg upon a ſoft-ſtuffed cuſhion.

Theſe legs have no flexion at the knee, and the hollow for receiving the thigh goes up near to the hip: It opens behind to admit the thigh; it is fixed with three ſtraps and hooks, which laſt are not only ſtronger, but leſs bulky than buckles.

When a limb is amputated above the knee, a joint is formed in the artificial leg at the knee. In walking, the limb is made ſteady by a ſteel bolt running in two ſtaples on the outſide of the thigh, being puſhed down; and when the patient ſits down, he renders the joint flexible by pulling the bolt up. This is eaſily done, and it adds much to the utility of the invention.

The reſt or ſupport in this leg is obtained in part from its embracing the upper part of the thigh tightly, but chiefly from the back-part of the thigh-box being ſtuffed in ſuch a manner that the lower part of the hip reſts upon it with nearly the ſame eaſe that one does in ſitting on a ſtuffed chair; and, in fact, a perſon ſits on it when he either ſtands or walks; by which, and by the ſtrap carried up from the ſole of the foot to the ſhoulder, the limb is eaſily carried about.

Mr Wilſon's artificial arms, beſides being made of firm hardened leather, are covered with white lambſkin, ſo tinged as to reſemble the human ſkin. The nails are made of white horn, tinged in ſuch a manner as to be an exact imitation of nature.

The wriſt-joint is a ball and ſocket, and anſwers all the purpoſes of flexion, extenſion and rotation. The firſt joints of the thumb and fingers are alſo balls and ſockets made of hammered plate-braſs, and all the balls are hollow to diminiſh their weight. The ſecond and third joints are ſomewhat ſimilar to that which anatomiſts term Ginglimus, but they are ſo far different as to admit of any motion, whether flexion, extenſion, or lateral.

The fingers and metacarpus are made up to the ſhape, with ſoft ſhamoy leather and baked hair. In the palm of the hand there is an iron ſcrew, in which a ſcrew-nail is occaſionally faſtened. The head of this nail is a ſpring-plate, contrived in ſuch a manner as to hold a knife or a fork, which it does with perfect firmneſs; and by means of a braſs ring fixed on the firſt and ſecond fingers, a pen can be uſed with ſufficient exactneſs for writing.

When only a hand and fore-arm is needed, it is fixed to the arm above the elbow by a ſtrap of leather ſewed to one of the ſides of the artificial fore-arm. After making a turn and a half juſt above the elbow, the ſtrap is fixed on the back part of the limb at *D*, fig. 2.

When the arm is amputated above the elbow, the artificial limb is made with an elbow-joint. This part of it is made of wood, and has a rotatory motion as well as that of flexion and extenſion.

I have given this particular account of Mr Wilſon's invention, from a conviction of its being ſuperior to any with which the public is acquainted: I am alſo pleaſed at having it in my power to let the merit of ſuch an artiſt be more generally known than it otherwiſe might be.—Indeed his merit was ſo conſpicuous, that his death I conſider as a public loſs, at the ſame time that I often wiſhed that ſome public encouragement had been given him, to enable him to communicate as much as poſſible the reſult of his experience to others.

PLATE CI.

In Chap. XLVIII. I gave ſome account of an ingenious propoſal by Mr Moore of London, for diminiſhing and preventing pain in ſeveral operations of ſurgery. It is done by compreſſing the nerves of the limb upon which an operation is to be performed. In this Plate, I have repreſented the apparatus recommended by Mr Moore for this purpoſe.

Fig. 1. *A*, The compreſſing inſtrument, being formed of a curved piece of iron covered with leather, and of ſufficient

capacity to contain the thigh within its curve.

B, A firm compreſs of leather at one extremity of the inſtrument, to be placed on the ſciatic nerve.

C, An oval compreſs fixed on a ſcrew, paſſing through a hole at the other extremity of the inſtrument. This compreſs is placed on the crural nerve.

When the inſtrument is to be uſed, it is neceſſary in the firſt place to ſearch for the ſciatic nerve: For this purpoſe, let the operator feel for the tuberoſity of the iſchium, and then for the great trochanter; and ſuppoſing a ſtraight line drawn from the one to the other, apply the compreſs *B* about an inch above the middle of that line.

The crural nerve is found by the pulſation of the crural artery, which runs contiguous to it; the oval compreſs *C* muſt next be applied above it; and upon turning the ſcrew connected with it, the ſciatic nerve is preſſed by *B* againſt the edge of the ſciatic notch, and the crural nerve againſt the os femoris to any degree that is neceſſary.

Fig. 2. Repreſents the inſtrument adjuſted to the thigh; and fig. 3. a ſmaller compreſſor ſuited to the arm.

PLATE CII.

In this and the four following plates, I have delineated the inſtruments employed in midwifery.

The forceps is perhaps the beſt, as it is the ſafeſt inſtrument employed by the accoucheur.

Various forms of it have been recommended by practitioners; but the one delineated in this plate has been found to anſwer perhaps better than any other. It is ſufficiently long, and the blades apply with perfect exactneſs to the child's head.

This inſtrument ſhould meaſure eleven or twelve inches in length. Some have alleged that they ſhould be longer, in order to prevent their locking within the vagina, and that they may with more eaſe be applied when the head of the child lies high in the pelvis; but the length I have mentioned is by experience found to be ſufficient.

PLATE CIII.

Fig. 1. Sciſſars uſed for perforating the ſkull of the fœtus where the pelvis is ſo narrow that delivery cannot be otherwiſe accompliſhed. After emptying the cranium of its contents, the child is extracted piece-meal either with the crotchet or blunt-hook, fig. 2. Plate CIV. or with the forceps, figures 1. or 3. of the ſame plate.

The ſciſſars here repreſented are thoſe recommended by Dr Denman.

Fig. 2. A ſingle blade of the common crochet, an inſtrument employed for tearing away the fœtus piece-meal when it cannot be delivered entire. From the form of this inſtrument, it obviouſly cannot be uſed but with much riſk even of hurting the mother. The beſt rule for

preventing this is to keep the point always towards the fœtus.

Fig. 3. The two blades of the crotchet locked together; in which way they may be uſed with perfect ſafety to the mother.

PLATE CIV.

The forceps, figures 1. and 3. as well as the blunt-hook, figure 2. of this plate, are intended, as was mentioned in the explanation of the preceding plate, for extracting the fœtus piece-meal, when it is judged neceſſary to accompliſh delivery in this manner.

PLATE CV.

The inſtruments in this plate, and the fillet, fig. 3. in Plate CVI. are the invention of my friend the late Sir Thomas Bell, a practitioner of eminence in Dublin. They are chiefly intended for extracting the head of the fœtus, when by accident or improper management it is ſeparated from the body in caſes of narrow pelvis.

By a proper application of the fillet the head is ſteadily fixed till it is ſufficiently opened for diſcharging the brain; when, with the forceps here delineated, the parts are extracted. Theſe forceps conſiſt of two blades; one nearly of the ordinary form; the other convex; and its convexity being adapted to the concavity of the other, the two occupy much leſs ſpace than they otherwiſe would do; by which they are peculiarly well fitted for acting in a narrow pelvis. The teeth with which one of the blades is furniſhed, give theſe forceps a very firm hold of any part to which they are applied: And as they may be uſed with ſafety, I think it probable that in many caſes they may ſuperſede the uſe of the crotchet.

PLATE CVI.

Fig. 1. A fillet of whalebone covered with a ſheath, which by ſome is employed, in difficult labours, for pulling down the head of the fœtus. In general, however, the forceps anſwer better.

Fig. 2. A curved inſtrument, with an opening at one end, for applying ligatures round polypous excreſcences in the uterus. It is the invention of the late Dr Hunter of London, and it anſwers the purpoſe in the eaſieſt and moſt effectual manner.

Fig. 3. A fillet mentioned in the explanation of the preceding plate as the invention of Sir Thomas Bell of Dublin: It is a material improvement of the common fillet repreſented in figure 1. of this plate.

PLATE CVII.

Fig. 1. I have here delineated a night-cap, fixed in ſuch a manner as to ſerve as one of the beſt bandages for the head.

Fig. 2. The common triangular napkin, or couvre-chef of the French, uſually employed as a bandage for the head.

Fig. 3. The radiated bandage, as it is uſually termed. It is commonly employed for compreſſing the temporal artery; and it anſwers equally well for ſtopping hemorrhagies in any arteries of the head, as may be ſeen in fig. 4. where the knot or turn is made at the angle of the jaw.

Fig. 5. The bandage uſually employed for fractures of the lower jaw, as well as for wounds and other injuries of the under lip and chin.

Fig. 6. A bandage for ſupporting the head. It is formed by a proper application

cation of the double-headed roller, fig. 2. Plate CVIII.

PLATE CVIII.

Fig. 1. A common ſingle-headed roller; a bandage that anſwers for various purpoſes in ſurgery.

Fig. 2. A double-headed roller.

Fig. 3. A double-headed roller with a ſlit in the middle, forming what is termed the Uniting Bandage.

Fig. 4. A four-headed roller, uſually employed for fractures of the lower jaw and injuries of the contiguous parts.

Fig. 5. A bandage with twelve heads or tails applied to a leg. This, as I have had occaſion to obſerve in various parts of this work, is the moſt uſeful bandage for fractures, as well as for many other affections of the thighs and legs. In fig. 7. I have repreſented a bandage of the ſame

kind, made in a manner commonly uſed in ſome of the London hoſpitals.

Fig. 6. The uniting bandage, fig. 3. applied to a wound in the arm.

PLATE CIX.

Figs. 1. and 2. A front and back view of the napkin and ſcapulary, the moſt uſeful bandage for almoſt every part of the thorax and abdomen.

Figs. 3. and 4. Different forms of the T-bandage. This bandage proves particularly uſeful in diſeaſes of the anus and perineum. *D*, a hole for admitting the penis. At *E*, that part of the bandage which paſſes between the legs is divided into two; one part of it paſſing on one ſide of the penis and ſcrotum, and the other on the oppoſite ſide.

PLATE CX.

In this plate I have delineated the different forms of ſuſpenſory bandages for the ſcrotum. They may be made either of linen, cotton, or flannel; but ſoft cotton anſwers beſt.

Each bandage conſiſts of a circular *A*, which is fixed round the body above the bones of the pelvis, and a pouch or bag connected with this: The principal difference between them conſiſts in the form of the pouch, and in the manner by which it is fixed to the circular. In figs. 1. 2. 3. and 4. the pouch is connected with the circular both before and behind. Of theſe, fig. 3. I think is the beſt.

Where the ſcrotum is of ſuch a ſize, that the pouch or bag, when fixed upon it, will remain, the two bands, which paſs between the thighs for fixing it behind, are unneceſſary: Fig. 5. repreſents a form of it for this purpoſe.

PLATE CXI.

The figures of this plate repreſent the different forms of ſcalpels in common uſe: Any of them anſwer the purpoſe, but fig. 1. cuts more eaſily than the others. Fig. 4. proves uſeful in ſome of the leſſer operations, ſuch as opening the ſac in the fiſtula lachrymalis. This laſt is of a full ſize for theſe purpoſes; but the larger ſcalpels ſhould be ſix inches long, and ſtronger than they are uſually made.

PLATES CXII. and CXIII.

In theſe two plates I have delineated inſtruments for a pocket-caſe, for which ſurgeons have daily occaſion.

Plate CXII. fig. 1. Forceps. Fig. 2. a round-edged ſcalpel. Fig. 3. crooked ſciſſars. Fig. 4. a caſe for cauſtic and red precipitate.

Plate CXIII. figs. 1. and 3. Different forms of probes. Fig. 2. a ſpatula. Fig. 4. a director.

Theſe with a probe-pointed biſtoury, fig. 3. Plate LXIV.; a tenaculum, Plate III. fig. 1.; a ſcarificator, Plate XXXVI. fig. 4. and a few crooked needles of different ſizes, form a very complete ſet for a pocket-caſe.

FINIS

DIRECTIONS to the BINDER.

PLATE I. to XI. incluſive, to be placed at the end of VOL. III. *before the Explanation of the Plates.*

PLATE XII. to XL. at the end of VOL. IV.

PLATE XLI. to LXVII. at the end of VOL. V.

PLATE LXVIII. to LXXXVII. at the end of VOL. VI.

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